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Recent Advances in the

Physical Chemistry of Dyestuff Solutions

By S. M. NEALE, M.Sc.

During the last half century organic chemistry has made possible great technical advances in the synthesis and commercial production of new dyestuffs, which are now obtainable in the widest variety of shades for use on textile materials of every description. On the physical side, however, progress has been made at a much slower rate and little is known of the exact state of a dyestuff in solution.

IT IS generally understood that the individual molecules, whose structure has been demonstrated by the organic chemist, are in some way aggregated into larger units in most dyestuff solutions. This supposition is most probably true in the case of the direct cotton colors. There is not available, however, any real knowledge of the extent of aggregation in dyestuff solutions, and since aggregation is essentially a quantitative phenomenon, so long as it remains only qualitatively estimated its very existence must be in some doubt.

The idea that certain dyestuffs are aggregated in aqueous solution arises partly from the fact that they cannot diffuse through membranes of collodion or parchment such as are commonly employed in colloid chemistry. One has only to reflect, however, on the very large size of a single dyestuff molecule—the average direct cotton color has a molecular weight of the order of one thousand—to realize that the inability to penetrate certain membranes might arise from this cause alone, without assuming any aggregation into still larger units. In fact, the solutions are bound to be more or less "colloidal" by virtue of the large size of the simplest possible chemical units of the substance, just as a gold sol is colloidal by virtue of the association of many of the smaller individual atoms into larger units.

Apart from their behavior with membranes, support for the view that dyestuffs are colloidal or aggregated in solution is afforded by their sometimes high viscosity, by the fact that they show particles in the ultramicroscope and may be completely flocculated by the addition of electrolytes. It is, however, by no means clear how far the appearance of these colloidal properties is dependent on the presence of extraneous electrolytes, which are found in large quantities in commercial dyestuffs.

Some of the most definite attempts to determine the particle size of dyestuffs have been made in Germany by the method of diffusion in water. A solution of the dyestuff is brought into juxtaposition with pure water, and diffusion is allow to proceed. From the distribution of diffused color after a given interval of time the coefficient of diffusion is obtained. In the case of a simple colloid this is related to the particle size by the equation of Einstein:—

$$D = \frac{RT}{N} \cdot \frac{1}{6\pi\delta r}$$

where $\frac{RT}{N}$ is an osmotic factor representing the force causing diffusion and $6\pi\delta r$ a factor representing the viscous drag on the moving particles of radius r. In this way the following values of the diffusion coefficient which are taken from Freundlichs "Kappilar-Chemie," Eng. Edr., 1926, L548, and from the work of Schramek and Götte (Golloid-Beihefte, 1931, *34*, p. 218) have been determined.

Dyestuff	*D cm./sec. x* 10^6
Freundlichs:	
Naphthol Yellow S	4.7
Chrysoidine	4.9
Ponceau 3R	2.5
Congo Red	1.26
Crystal Violet	4.0
Schramek and Götte:	
Dianil Blue R	1.8
Oxanine Violet	2.6
Bordeaux CO_2	4.1
Compare An SO_4	4.6

From the values of D Schramek and Götte have calculated the particle size, by means of the equation of Einstein.

The determination of particle size on these lines, however, has during the last few months been shown to be invalid. The equation used assumes that the aggregation (if any) is one of electrically neutral dyestuff molecules, giving rise to an aggregate which carries at most only a

feeble electrical charge. In other words, the solution is treated on the same lines as a simple colloid such as a gold sol, whose particles, carrying a weak electrical charge, are built up of neutral metal atoms. The recent work of Robinson and Mills*, however, has recently shown that solutions of the typical cotton dyestuff Benzopurpurine 4B must be regarded as strongly ionized, the solution being an electrolyte or more probably a "colloidal electrolyte" of the McBain soap solution type. The isomeric substance prepared from meta-tolidine behaved in a similar way, and indeed the structural similarity of the direct cotton colors is such that one feels little doubt of the general validity of the facts established by Robinson and Mills. Indeed the mere reflection that these colors are in general the sodium salts of sulphonic acids leads to the conclusion that they must be quite strongly ionized in water.

Several years ago McBain and his co-workers showed how such strong ionization could, in the aqueous solutions of soaps, be reconciled with other properties indicative of a colloidal or highly associated nature. The soaps, which are the alkali metal salts of long chain hydrocarbon acids, were supposed to be largely ionized in water, giving rise to individual alkali metal ions and more or less highly aggregated negative fatty ions or "ionic micelles." Robinson and Mills suggest that similar considerations apply in all probability to the dyestuff solutions. Indeed it is more easy to visualize a mechanism for the association or aggregation of dyestuff ions with their abundant polar groups. The lack of any clear picture of such a mechanism was perhaps the weakest point in the McBain theory of the soap solution micelle.

The evidence for the views of Robinson and Mills is clear and conclusive. The high electrical conductivity of the dyestuff solutions takes first place. This shows that the dyestuff ions must have roughly the same equivalent conductivity as the sodium ions, since Benzopurpurine has an equivalent conductivity of about 90 in dilute solution. The osmotic pressure—which must be determined in presence of a trace of alkali to prevent the Donnan membrane hydrolysis—agrees with the supposition of free sodium ions and aggregated negative dyestuff acid-ions. Robinson and Mills show that many of the properties which were previously considered typical of the colloidal nature of Benzopurpurine solutions are in reality dependent on the presence of foreign electrolytes. Solutions of the carefully purified dye sodium salt have a viscosity inappreciably higher than that of pure water, are void in the ultramicroscope, and do not show streaming double refraction. Ultrafiltration through nitro cellulose filters indicates a certain degree of aggregation of dyestuff ions, greater in the 4B dyestuff prepared from orthotolidine than in the isomeride prepared from meta tolidine, which isomeride has little affinity for cotton.

The use of the Donnan theory of membrane equilibrium shows that the observed osmotic pressure of a dyestuff solution, using a membrane impermeable to the dyestuff ion only, should decrease with addition of a diffusible electrolyte such as sodium chloride. In presence of an excess of common salt the observed osmotic pressure should correspond to the dyestuff ions alone, and so should permit of a direct measurement of their aggregation. Using the meta isomeride of the dyestuff this technique leads to the conclusion that about twenty of the simple dyestuff ions are aggregated to form a single micelle. For the dyestuff itself, however, the technique is inapplicable, since salt throws it out of solution. It can only be concluded in a qualitative way, from other observations such as ultrafiltration and the appearance of particles in the ultramicroscope, that the ions of the dyestuff itself do aggregate, at any rate in presence of sodium chloride. The general result of this work has been to show that dyestuffs must be treated as colloidal electrolytes, and not as simple colloids in solution. The problem of determining their aggregation is still unsolved, indeed old ideas have been upset so that we appear further from the goal than ever.

The treatment of the dyestuffs as simple colloids, which led from diffusion measurements to definite A— values for the particle radius is now seen to be invalid. The problem of the diffusion of a colloidal electrolyte is a very different and a much more complicated one. Robinson and Hartly have attacked it in a recent paper*. They show that the mechanism of the diffusion would be such that the mobile sodium ions advance first, and the large dyestuff anionic micelles follow under the influence of the induced potential gradient rather than by virtue of their own osmotic tendency to diffusion. This leads to the conclusion that the rate of diffusion of the color is determined mainly by the electrical mobility of its ions, which as Robinson and Mills had shown, is quite high. This work is at this stage highly mathematical in character but the results are very interesting. It is shown that pure dyestuffs should diffuse about as fast as an electrolyte like copper sulfate, but that the rate of diffusion should be very much decreased by the presence of foreign electrolytes. Both these theoretical conclusions have been verified by preliminary experiments. It is suggested that the low value for diffusion coefficient of dyestuffs which have often been obtained may be due to the use of impure dyestuffs since it is really a matter of extreme difficulty to obtain direct cotton dyestuffs in a chemically pure form. Robinson and Mills purified their samples by repeated salting out with sodium acetate, a tedious process which gives a poor yield.

The general problem of determining, from the point of view of the physical chemist, the state of dyestuffs in solution is at a most interesting stage of development. Its satisfactory solution will be necessary preliminary to any well founded speculations on the theory of dyeing with direct colors.

*Proc. Roy. Soc.. 1931, *A131.* 576.

*Proc. Roy, Soc., 1931, *A134,* 20.

Rayon Dyeing and Finishing—3

(Continued from page 230, March 27th issue)

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CHAPTER II—CONSIDERATION OF RAYON FROM THE VIEWPOINT OF THE PRACTICAL TEXTILE CHEMIST

The regenerated cellulose types of rayon differ so greatly from the cellulose acetate types that we will deal separately with these two classes of synthetic fibers in this chapter.

Regenerated cellulose rayons react towards most textile chemicals in the same general manner as do the natural cellulose fibers, except that the regenerated cellulose rayons are less resistant to chemical action.

Cellulose acetate rayon reacts so differently from the other rayon fibers that the effect of each of the ordinary textile chemicals on this fiber must be considered separately.

Effect of Textile Chemicals on Regenerated Cellulose Fibers

Water

Water causes regenerated cellulose fibers to increase appreciably in all dimensions. This increase in size is due to the inclusion of water within the yarn. It causes the yarn to become less resistant to physical action of all kinds. Thus the tensile strength is appreciably lowered and the susceptibility to mechanical abrasions tremendously increased while the fiber is in the wet state.

When the water is removed from the fabric, it assumes its original state, and is fully as strong as it was before coming in contact with the water.

The lower resistance of rayon to physical action while in a wet condition often causes flat woven rayon fabrics to become excessively stretched during the wet treating process. That is, either during the warp sizing operation, or during the scouring and dyeing operations or both, rayon warp fabrics are sometimes stretched far beyond their elastic limit with the result that an increased yardage is produced at the expense of many of the most desirable properties of the finished fabric. This practice results in the production of inferior fabric, and should not be condoned.

Alkalies

In general, regenerated cellulose yarns react with alkali in the same manner as normal cellulose (cotton) with this exception: The resistance of regenerated cellulose to alkali is considerably less than the resistance of cotton to alkaline liquors. Appreciable quantities of alkali cause regenerated cellulose yarns to soften and become less resistant to the action of physical force.

Very strong alkaline solutions will cause some regenerated cellulose rayons (for example Viscose) to soften and swell to such an extent that they appear to have completely dissolved and to have filled the entire container in which they have been treated. The fact that the fiber has not dissolved, but is only swelled can be easily demonstrated by adding acid to the alkaline solution, whereupon the fiber contracts to its original size. It is obvious that the reprecipitated yarn does not possess the physical properties with respect to strength, etc., of the original untreated yarn.

It is impractical to make general statements regarding the comparative resistance of the three types of regenerated cellulose rayons to alkali as variations within the Viscose Process alone are very great. There are appreciable variations in the resistance to alkali of rayons from various manufacturers, irregardless of the process used.

Whereas alkalies soften regenerated cellulose yarns and cause them to swell, become more easily injured by chafing, etc., acids tend to prevent swelling of rayon filaments. Acids cause the rayon to become comparatively hard and firm when they are in contact with the yarn.

In general, kier boiling of rayon is to be avoided as too dangerous. Many thousands of pounds of rayon, and rayon containing fabric, have been ruined by kier boiling operations. Nevertheless, it does not follow that rayon *cannot* be kier boiled. Large quantities of rayon containing fabric have been successfully processed. Success in handling rayon in the kier depends upon extreme care, and a mild kier operation.

Rayon containing fabrics have been, and can be successfully mercerized when every precaution is taken. These precautions consist of "buffering" the mercerizing liquor with sodium acetate, etc. However, the operation is dangerous, and must be given extremely careful super-

vision. Ordinary mercerizing baths seriously weaken or destroy most regenerated rayons.

Vat dyeing liquors ordinarily used for cotton yarns can be used on rayon yarns with no hesitation. Alkaline liquors of this concentration will not harm regenerated cellulose rayons. It does not follow that a vat dyeing process that works successfully on cotton skeins will give equally good results on rayon skeins. Indeed, the reverse is true. However, a dyer need have no hesitation with respect to the effect of the quantities of caustic ordinarily used in vat liquors.

Regenerated cellulose rayons can be successfully dyed with the sulfur dyestuffs. However, care must be taken that excessive quantities of sodium sulfide are not used, in order to prevent tendering the yarn as well as undesirable harshness.

Some dyers have avoided the danger existing in sulfur dye baths for regenerated cellulose rayons by buffering said dye baths with sodium acetate. As the quantities of sodium sulfide, sodium acetate, etc., that can be safely used of necessity vary considerably from one rayon to another, it is impossible to give a general formula that can be safely used in all cases.

All scouring baths that are customarily used in conjunction with cotton fabrics can be safely used on regenerated cellulose fabrics in-so-far as the effect of this bath on the strength of the ultimate fabric is concerned.

Care must be taken that printing pastes applied to regenerated cellulose fabrics shall not be too strongly alkaline as the softening effect of concentrated alkali in the ager temporarily weakens printed fabrics so seriously that they sometimes break within the ager, thus causing a very considerable amount of trouble.

As stated above, it is possible to process rayon and rayon containing fabric in the kier, mercerizing range, in vat dye liquors, sulfur dye liquors, etc. Nevertheless, the temporary softening effect of alkalies on regenerated cellulose yarns must be carefully considered at all times. Rayon and rayon containing fabric must often be given special handling from a mechanical viewpoint when treated with alkaline liquors in order to prevent mechanical abrasion of the surface of the fabric. Lack of attention to this fact has caused many thousands of dollars worth of rayon fabric to be damaged by chafing.

Soaps

Soaps used in ordinary textile concentrations have no direct effect on regenerated cellulose rayons.

The improper use of soap in conjunction with rayon and rayon containing fabrics still causes a surprisingly great amount of trouble from the production of rancid fabric. When soap alone is used, there is a tendency for the ionized fatty acid from the soap to adhere to the individual rayon filaments during the scouring operation. When this happens, the alkali radical of the soap stays in the bath and is passed from the kettle when the bath is dropped. It is then inevitable that the fatty radical of the soap used shall remain on the fabric through the remainder of the wet-treating process. During the drying operation, or during subsequent storage, this free fatty acid radical (partly depending on the soap used) is very likely to turn rancid and cause the goods to have a very objectionable odor.

In the case of the rayons delustered by means of the inclusion of small globules of oil within the individual filaments, this tendency is greatly exaggerated as the fatty radical of the soap adheres tenaciously to the minute oil globules.

In some instances, particularly when zero soft water is used, so much of the free fatty acid from the soap has been retained by the minute oil globules within delustered rayons, *THAT THE RESULTANT FABRIC HAS BEEN GIVEN A PRONOUNCED SCROOP, EVEN THOUGH THE GOODS WERE REMOVED FROM AN ALKALINE BATH.*

An undesirable scroop, produced in the normal course of textile work in such a manner, can be eliminated by three means:

(1) The use of additional alkali in the scouring bath.
(2) The use of a considerable amount of alkali in the rinsing bath.
(3) The use of hard water or soluble calcium, or magnesium compounds in the final rinse.

Use of sufficient alkali in the scouring bath retards the ionization of soap sufficiently to effectually prevent the production of rancid batches of scoured fabric. The use of small quantities of solvents such as soluble pine oil in the scouring bath always serves to reduce trouble from this source. When the finish required is such that metallic soaps are not objectionable, a final rinse in hard water will effectually prevent the production of rancid batches.

Soluble Oils

Many mills in the hard water regions are unable to use soap as a scouring material due to the presence of tremendous quantities of lime and magnesium compounds in the water. These mills scour fabric by the use of sulfonated oils in combination with a large quantity of tri-sodium-phosphate or a related compound, and a solvent.

Sulfonated oils have no direct effect on regenerated cellulose during the wet-treating process.

The principal difference between the action of soaps and sulfonated oils in the scouring bath is the tendency of the sulfonated oils to cling tenaciously to the individual rayon filaments. This tendency is easily noted in the skein dyeing operation, as sulfonated oils used in the dye bath are absorbed by the rayon skeins thus causing the skeins to hang more straight in the dye bath than in the case when soap is used.

Part of the sulfonated oils used in the scouring and dyeing baths adhere so tenaciously to the individual filaments that they are carried through the rinsing opera-

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PROCEEDINGS OF THE
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New Tools for Industry*

By **N. D. HARVEY, Jr.**
Carbide and Carbon Chemicals Corp.

CHEMICAL history is replete with interesting narratives describing the origin of present basic chemical materials; there frequently being amusing circumstances involved in certain important discoveries and in the formulation of certain hypotheses. It may be said that as a true science, chemistry is one hundred to two hundred years old, although practiced in some form continuously since prehistoric times. The origin of the science must be sought in the art of alchemy. Thousands of years ago, scientists were attempting to form gold and silver from base metals. History relates of glass, clothing. pottery, coloring matter, and soaps, such as they were, resulting from the ingenuity and the imagination of the peoples of those times. As the years passed, and the master chemical minds gradually unfolded the mysteries surrounding chemical substances, so familiar and simple to us, chemistry commenced to take on understandable and logical forms.

In 1825, Faraday discovered an isomer of ethylene chloride.

In 1828, while evaporating a solution of ammonium sulfate and potassium cyanate, Wohler synthesized urea. This accomplishment marks the beginning of organic chemistry as a distinct branch of the science. Further development from this starting point was slow and laborious, one obstacle to a more rapid advancement being the imperfection of analytical methods.

*Presented before R. I. Section Dec., 1932.

The origin of the present day conception of the benzene ring as a closed chain of six carbon atoms is of interest. One evening, Kekule was engaged in the writing of a textbook. Unable to make progress as his mind was on other things, he moved over before the open hearth and dozed. Atoms jumped before his eyes in small groups, and he could isolate long chains here and there, firmly joined, all winding and turning with a snake-like motion. Suddenly one serpent caught his tail in his mouth, and the ring thus formed persisted in an exasperating manner. Kekule spent the rest of the night working out the logical consequences of his hypothesis. He once said, "If we learn to dream, we shall perhaps discover the truth. But let us beware of publishing our dreams until they have been tested by the waking conscience." Thus originated the accepted theory that the extraordinary stability of this compound is due to its closed chain structure.

The foundations for the important coal tar industries, especially relating to dyestuffs, were laid by Hofmann in the years 1818 to 1892, and the first synthetic color was formed in 1856 by Perkin, an assistant of Hofmann. Tar was recovered as a by-product in the distillation of coal, and until the middle of the nineteenth century little use had been found for it except as a fuel. In 1843, Hofmann discovered aniline in coal tar and started his researches on the amines. In 1845, he isolated benzene from the same raw material and the production of synthetic aniline in large quantities followed. Greiss, another student under Hofmann, studied the diazo compounds, and the manufacture of azo compounds and dyes was founded on results of his investigations. Alizarin followed in 1868 from the work of Graebe and Lieberman, and the synthetic production of indigo from naphthalene by Baeyer, after years of laborious and costly work. In quick order appeared plant perfumes, remedial agents, and synthetic medicines, and explosives. Mustard gas was prepared and identified in 1822. Its use in present day chemical warfare is comparatively new.

It has been said, "For good or for ill, chemistry as a creative art came into its own. The modern world became dependent upon the chemical research, knowledge, and skill of the technical chemist."

The chemistry of benzene and of its derivatives is that of the closed chain or aromatic series. The development of this important branch of organic chemistry has brought thousands of commercial tools with which to work, tools benefitting many industries, viz.: oils, fuels, pitch, coke, protective coatings, electrodes, insulation, resins, drugs, antiseptics, acids, phenols, naphthalene, salicylates, preservatives, explosives, indicators, laxatives, perfumes, benzene, dye intermediates, dyestuffs, sulfonic acids, developers, and phenyl hydrazine. The chemical literature deals very fully with the subject of the aromatic series. Methods of synthesis, chemical and physical properties, and commercial uses, fill volumes, ample testimony to the ingenuity, perseverance, and imagination of the scientist.

The descriptive literature also deals with the subject of the second large organic chemical series, the open chain or aliphatic group. But this is small in comparison with the aromatic series. This branch has not been developed to the same extent as the closed chain group. The reason is obvious. The raw materials for the aromatics, viz.: benzene, toluene, etc., are liquids, and easily obtainable in the pure state. The basic materials for the aliphatics, being gases, have been difficult to obtain in the pure state and require a different technique in handling. Today the situation is quite different. The present development of the aliphatic series is the center of interest. These compounds offer new tools with which to work in the perfection of present methods, and in the development of new. Many of these compounds have never before been manufactured on a commercial scale, and some of them are not mentioned in the chemical literature. The imaginations of our chemically trained men are finding new and important applications for the aliphatic oxides, alcohols, esters, ethers, amines, and chlorine derivatives. New tools mean new methods; new methods mean new economies; new economies mean progress. In such a vast program of development, new problems naturally arise which may be approached from either of two angles.

In the synthesis of a new chemical compound, it is not always possible to produce the one compound without the formation of secondary products from side reactions. There usually is a definite purpose in producing the primary product, but possibly no known uses for the secondary materials. New uses must be developed for the by-products as well as for the main product. Economics requires that all products be disposed of in the interests of lower manufacturing costs and greater manufacturing efficiency. This is of major importance.

Everyone concerned with the technical end of business is constantly conscious of imaginary compounds possessing definite physical and chemical properties suited to a definite use, which, if available, would greatly simplify or improve a known and practiced art. This may be considered another method of approach to a problem. Knowing the use to which an imaginary chemical could be applied, and knowing the definite properties which it must possess, an attempt is made to synthesize the desired compound. The answer to each of these situations depends upon the existence and employment of two requisites,—the tools with which to work, more specifically, raw materials; and imagination. There is little possibility that imagination as a human trait will disappear, while new raw materials will continue to appear. As a starting point for further synthesis, coal was available and is available in large quantities. The existence of this raw material, of scientific thought, and of imaginations,

has been the basis of thousands of important derivatives comprising the aromatic series.

Approximately fifteen years ago, certain technicians realizing the tremendous possibilities of the aliphatic chemicals field, and the existence of a practically inexhaustible supply of raw materials, investigated methods of synthesis. Today there are some fifty-five aliphatic chemicals being produced on a commercial scale with ten to fifteen new ones added each year.

Ethylene Glycol

Ethylene glycol, chemically the simplest of the glycols, lies between ethyl alcohol and glycerine in physical and chemical properties. It boils at 197 degrees centigrade, is colorless, odorless, water soluble, and hygroscopic. Ethylene glycol is not a solvent for nitrocellulose. Its large industrial applications include the manufacture of anti-freeze solutions for the cooling systems of automobiles and aeroplanes, and in sprinkler systems. Ethylene glycol dinitrate, used to the extent of 20% with nitroglycerine, produces dynamites which are non-freezing and which retain their sensitivity at low temperatures. Ethylene glycol is a solvent for water soluble dyestuffs, is a conditioning liquid, and is a swelling agent for rayon and wool. Speakman states that the swelling action of ethylene glycol on wool closely approximates that of water itself, with the added advantage of a materially slower evaporation rate.

The synthesis of ethylene glycol initially produced diethylene glycol as a by-product. Four years ago, the stocks on hand of the secondary material were both cumbersome and embarrassing. Its availability aroused an interest which grew rapidly, and the reserve soon vanished. At the present time diethylene glycol is not a by-product, but is produced commercially in large tonnage. Applications for diethylene glycol include the dyeing and printing of textiles, the lubrication of combed wool for the manufacture of knitting yarns, as a constituent of soluble oils, soaking compounds, softeners, conditioning agents, yarn tinting solutions, sizing and finishing compounds, book binding glues, the manufacture of cork and linoleum, to mention but a few of the more important uses.

Propylene glycol is next in the series and is becoming an important industrial solvent. The three glycols resemble each other in a general way, being colorless, odorless, water soluble, neutral, stable, and hygroscopic. They differ in boiling points, rates of evaporation, viscosities, and solvent powers.

The list of glycols and glycol ethers is quite complete as regards boiling points, solubilities, solvent powers, and evaporation rates, and today practically all solvent requirements are satisfied by this group.

The Cellosolves

*Cellosolve, the monoethyl ether of ethylene glycol, was introduced initially as an alcohol substitute. This glycol ether proved to be a strong solvent for essential oils, but unfortunately indicated some toxic properties when taken internally, which fact eliminated it from the flavoring extract field. Further investigations, however, showed that Cellosolve was the best known solvent for nitrocellulose and soon developed wide applications in the formulation of lacquers, particularly odorless lacquers for interior finishes. Today Cellosolve is a solvent of universal applications. It finds general use in the dyeing and printing of textiles, particularly with the classes of dyes possessing excellent fastness to sunlight and laundering. It is claimed that Cellosolve maintains a more complete solution of those colors requiring an alkaline medium for solubility. Its dispersive and penetrative properties are valuable in the scouring of textiles, in the formulation of penetration assistants, and in special finishes.

Methyl Cellosolve is the monomethyl ether of ethylene glycol. One large industrial use is its application as a sealing material for moisture-proof Cellophane. The importance of this development is readily realized when one considers the diversified uses of Cellophane as a wrapping material for cigars, cigarettes, candies, foodstuffs, and wearing apparel. Methyl Cellosolve also finds special applications in nitrocellulose lacquers, and is an excellent solvent for cellulose acetate.

Butyl Cellosolve, the monobutyl ether of ethylene glycol, is soluble in water to the extent of five parts per hundred at room temperature, and also is miscible with fatty and mineral oils. One of its first uses was as a coupling agent for emulsified oils. Curding and separation were eliminated by the dispersive and coupling properties of this ether, and the emulsions possessed improved penetrative ability, and stability. Because of its slight solubility in water and complete miscibility with naphtha, the addition of Butyl Cellosolve to dry cleaning soaps allows the incorporation of certain quantities of water with the soap in naphtha with no cloudiness due to precipitation. The penetrative properties of Butyl Cellosolve are quite high and this solvent is finding increasing applications in textile specialties for stock lubrication, scouring, kier boiling, silk soaking, etc. Butyl Cellosolve is not a swelling agent for cellulose acetate and may be used for the spotting and cleaning of this type of material. It is not a solvent for water soluble dyes, but does find use with the oil soluble colors, and the dispersed dyes used for cellulose acetate.

Cellosolve Acetate finds its chief application in the formulation of lacquers for the prevention of humidity blush. In water solution it can be hydrolyzed to an acid solution of acetic acid and Cellosolve.

*Trade Mark Registered.

Carbitol and Others

*Carbitol, the monoethyl ether of diethylene glycol, resembles its glycol generally, but is less hygroscopic, a stronger solvent, and of slightly lower boiling point. Its uses include the manufacture of laminated glass, as a skin softener in cosmetics. as a mutual solvent for soap-oil mixtures as in soluble oils, as a dyeing and printing solvent, and as a plasticizer.

Ethylene oxide is a gas with extensive possibilities as a raw material for further synthesis. Its chief industrial use is as a fumigant for insect control in wool, foods, candies, fruits, furs, homes, and boats. For this use Ethylene oxide is particularly well qualified. Being relatively non-toxic to man but fatally effective against insects, this gas is a progressive step in the elimination of hazards accompanying the use of the more lethal fumigants. It was found that if eight parts of carbon dioxide are mixed with one part of ethylene oxide, the efficiency of the latter is materially increased. The presence of carbon dioxide causes a more rapid respiration by the insects, causing them to inhale larger quantities of ethylene oxide, consequently decreasing the time of fumigation.

The commercial mixture of carbon dioxide with ethylene oxide is called, *Carboxide. Its use as a fumigant is quite simple and without danger. The availability of solid carbon dioxide, "Dry Ice," allows its incorporation with the liquid oxide to form a slush, which, in grain fumigation, is shoveled into the grain stream as it enters the storage bin. This thorough mixing, with the vaporization which occurs inside the bins, produces a uniform and complete distribution of the fumigant, resulting in a complete kill. For the fumigation of wool, the mixture of gases is supplied in convenient cylinders under pressure. The required number of containers is set in the gas-tight room containing the wool, or led in through pipes set at intervals around the walls. The cylinder valves are opened, and the room left closed for perhaps twenty-four hours. Pressure distributes the gas and penetration is obtained throughout the wool, whether it be in the form of raw stock, top, or yarn. Moths, buffalo bugs, larvae, and eggs, are destroyed.

Chlorinated Solvents

Among the chlorinated group of solvents, this new development has produced ethylene dichloride, propylene dichloride, and dichlor ethyl ether. These solvents are insoluble in water, of ether-like odor of varying boiling points, and of comparatively low toxicity.

Ethylene dichloride, boiling at 83.5 degrees centigrade, is the more active solvent of the group. It is the most resistant to hydrolysis of the series, may be distilled with water in metal stills without corrosion or acidity and is less toxic than most chlorinated solvents. Ethylene dichloride finds extensive use in fumigation, as an extractant of pyrethrum, a widely used insecticide and spray, for the removal of oils from waste, for degreasing operations. Its penetrative properties indicate its application in the preparation of wetting agents, with soaps for scouring, for the removal of tar and paint brand marks from wool, for spotting, and for dry cleaning.

Propylene dichloride approximates ethylene dichloride in general properties, has slightly less active solvent powers, is less toxic, and boils at 98 degrees centigrade.

Dichlor ethyl ether is high boiling, 178 degrees centigrade. Its high boiling point with minimum loss from evaporation allows its use in processes involving extended periods of time, even at elevated temperatures. Dichlor ethyl ether has been widely used for the removal of tar and paint from wool during the fulling operation. It is distinctive in not thinning the fulling compound as do many solvents used for the same purpose. It is an excellent solvent for these obstinate brands and remains in the goods during the entire operation without appreciable evaporation. Other uses are as a penetrant in kier boiling, with soaps for scouring, and in the manufacture of wetting agents.

These three chlorinated solvents will burn when a flame is applied, but the flame extinguishes itself when the source of fire is removed. They are rendered completely non-inflammable by the addition of one part carbon tetrachloride to three parts of the solvent.

1,4 Dioxan, or diethylene dioxide, is a ring compound that may be considered as two molecules of ethylene oxide. It is an excellent solvent for cellulose acetate, resins, oils, waxes, and is used in the manufacture of plastics. It is a solvent for water and oil soluble dyestuffs, boils at 101 degrees centigrade, and is miscible with water and oils.

Ethanolamines

There are three ethanolamines, the mono-, the di-, and the tri-, substitution products formed by the replacing of one, two, and three atoms of hydrogen in the ammonia molecule with an equal number of ethanol groups. Commercial triethanolamine is a mixture of the three with the tri-substitution product predominating. This compound is a colorless, viscous, hygroscopic liquid, soluble in water, and high boiling. It is a mild alkali exhibiting the properties of an alcohol and of an amine.

Triethanolamine combines with fatty acids to form soaps varying in consistency from that of petrolatum to the solid waxes. These soaps are spirit-soluble, strong emulsifying agents, and excellent softeners for the reason that they do not dry. They are anhydrous, the reaction taking place with stirring only, in the absence of heat, except with the solid fatty acids. Triethanolamine is a strong penetrant, and mixed with cresol forms an efficient

*Trade Mark Registered.

wetting agent for mercerizing solutions. With oleic or stearic acids, triethanolamine produces very finely dispersed oil and wax emulsions suitable for a variety of purposes. This alkali absorbs acid gases at room temperatures, which in turn are disengaged on heating. The origin of triethanolamine is interesting as an illustration of the second approach to the synthesis problem previously mentioned. Given an imaginary compound, the desired physical and chemical properties of which are known, synthesize the compound. Several years ago, a certain concern had a definite use for a hygroscopic liquid amine of high boiling point and of low alkalinity. The synthesis of the ethanolamines had been completed successfully some time previous to the demand, but had not been carried to a commercial scale of production for lack of a definite outlet. A small sample was submitted to this concern, and from this has developed its present large scale availability.

Other Aliphatic Chemicals

There are many other aliphatic chemicals available with which industry is somewhat more familiar. Ethyl and isopropyl ethers, butyl alcohol, butyl acetate, methyl alcohol, acetone, crotonaldehyde, butyraldehyde, isopropyl acetate, methyl acetone, methyl acetate, isopropyl alcohol, triethylene glycol, ethylene chlorhydrin, propylene chlorhydrin, vinyl acetate, and vinyl alcohol, which are now manufactured synthetically, and available in any quantity. More complex compounds are now appearing, the complexity increasing with the higher members of the series. Aceto acetic ester, or ethyl aceto acetate, and methyl and butyl aceto acetate, are now produced by synthetic methods. Ethyl aceto acetate is used for the production of Hansa colors and anipyrin. It is extremely reactive and versatile substance, a raw material for the synthesis of amino-, halogenated-, and hydroxy acids, ketones, coumarines, and nitriles.

The development of the aliphatic series has entered the production of synthetic resins, specifically, Vinylite, or vinyl resins. Vinylite is permanently thermoplastic as differentiated from the thermo-setting compounds of the phenol-formaldehyde type. It is resistant to water, oils, acids, and alkalis, even in high concentrations. Vinylite is colorless but may be colored with dyestuffs and pigments to produce from the lightest to the darkest shades. The resin is applicable to the production of molded articles, protective coatings, on cloth, paper, metal, and wood, to impregnation, and to lamination. Vinylite may be precipitated as a film which is colorless, odorless, tasteless, clear, and transparent, with a high gloss. The film is resistant to water, oils, acids, and alkalis. Suggested textile uses are the finishing of cloth for washable wall coverings, shower curtain material, umbrella cloth, raincoats, acidproof aprons, and fabrics where chemical resistance is important. Being thermoplastic, and softened under heat, Vinylite may be firmly fixed to cloth and to paper by hot pressing. It is soluble in solvents such as acetone and esters, and may be applied from solutions in these solvents with or without the incorporation of a plasticizer.

In a very general way, the new aliphatic compounds have been described, established uses mentioned, and their properties discussed. The situation with which the technician is confronted today is an inspiring one. Some fifty-five new chemicals have become available, many of which were never before manufactured in commercial quantities, but were laboratory curiosities. Some are similar in physical properties but differ in chemical characteristics.

New Developments

An active imagination can visualize numerous additional compounds which, if they were available, would eliminate certain lengthy and costly operations, would allow more accurate process control, and would simplify and improve other manufacturing steps.

Mechanical improvements are being perfected constantly in all industries. In the textile field, new dyeing equipment has replaced the time-worn open tub; silk soaking machines have improved the results obtained from open tub soaking; mechanical alterations are increasing the efficiency and production of cards, combs, spinning machinery, and looms.

New cloth finishes have been developed, the outstanding example being the non-creasing effect produced by impregnation with thermo-setting resins.

Now the tremendous soap industry has been confronted with an imposing and dangerous competitor in the new sulfonated higher alcohols. This important development may have far reaching effects. The need for detergents of equal efficiency but lacking the instability of ordinary soaps has existed since the advent of soaps. Sulfonated oils have been a step in the right direction but they have not proved to be the final answer. Persistent efforts has been rewarded with the most interesting compounds introduced in many years. The need was present, and the properties of the imaginary compounds were known. The tools with which to work were available in large quantities. Now the finished product has appeared.

There are many other fields for thought with equally imposing possibilities. Mineral, animal, and vegetable oils have been indispensable to the textile industry since its birth. Tremendous quantities are utilized in the lubrication of stock, yarn, and equipment; in the production of soaps and sulfonated oils; in the manufacture of wetting agents, dye assistants, softeners, and finishes. These oils possess unusual merit for the work to which they are applied, but their after-effects leave much to be desired as dyers and finishers will testify.

Without an undue stretch of the imagination, one can conceive of a synthetic chemical compound possessing the desirable lubricating and softening properties of oils without their undesirable characteristics. This is not a new thought. Such a compound must be of agreeable odor, of light color, non-oxidizing, non-volatile, completely soluble in water, acid resistant, and neutral. It must possess the body, viscosity, and load resistance of oils without tackiness. Glycerine was considered to hold promise as a water soluble lubricant years ago, and has been used for the purpose with a certain degree of success. Diethylene glycol is used today on certain classes of stock in very sizable quantities, but it is not the final answer for all purposes. The important point is that these compounds have shown promise and may well be the starting point for the development of the material or materials for which a definite need exists. They have many of the properties desired and are deficient in others.

The raw materials for the synthesis of higher members of this series are available. The properties which the compound must possess are known. Already efforts to develop such a material have met with marked success. The compounds are readily synthesized, and it is entirely possible that in the not too distant future a water soluble stock lubricant will be available which will not require removal for dyeing, will not oxidize, will not produce resist spots, and will give uniform and more efficient carding, combing, spinning, and weaving.

Again, the buying public demands that the fabrics it purchases be dyed with colors which are fast to sunlight and to repeated washing. This demand has been met. Certain types of these fast colors require reduction in an alkaline medium for solution and application. Time is required and care must be exercised in maintaining a constant degree of reduction that the dyed shade may be uniform. The alkalinity necessary to the solubility of the reduced dye limits the applications of this type to fibers uneffected by solutions of high pH. If the alkaline requirement could be eliminated, the applications for these colors might be extended to wool, silk, and cellulose acetate.

Here is a known use for an imaginary chemical compound able to dissolve reduced dyestuffs in a neutral medium. Perhaps no solution is possible. On the other hand, perhaps the answer lies in some member of the aliphatic series as yet undeveloped.

A second group of fast colors requires an alkaline agent to maintain solubility and stability, the developing of the true color occurring in an acid vapor. Acid vapors are corrosive. There may be a solvent which will maintain the desired solution and stability in a neutral medium, allowing the true shade to develop during ageing as the solvent is volatilized.

A third and entirely different development is worthy of consideration. The silk industry utilizes the soaking process to soften the protective coating of sericin encasing the silk thread. Skeins of silk are soaked in emulsions of olive and/or neatsfoot oils until sufficient has been absorbed and adsorbed by the silk. The acidity of the gum reacts chemically with the alkaline constituent of the soaking solution, alters the pH, causes the emulsion to become unstable, and free oil is precipitated on and in the silk. The ideal situation is that the oil be so finely dispersed in the water phase that it readily penetrates the gum. When de-emulsification occurs, the precipitation of oil would take place in rather than on the threads.

It is perfectly possible to develop a material, soluble in water, or solvents if preferred, which would possess the softening and plasticizing properties of oils. Possibly the costly soaking operation would be eliminated entirely if the silk were passed through a solution of this imaginary compound in a volatile solvent, or in water, as the silk is unwound from the cocoon. Emulsification difficulties and surface deposits of oil would be eliminated. There are very important and attractive possibilities to such a procedure if one will consider the operation as now practiced.

These imaginary compounds and applications are mentioned because their availability would be of immediate importance, because investigations along similar lines have already been started, and with encouraging indications. These thoughts are purely products of a vivid imagination and not hidden promises.

Some of the more important uses found for the newer members of the aliphatic series have been described. Important additional applications will continue to appear. The development in progress will proceed at a rapid pace, making available primary products of known value, secondary products perhaps of unknown applications. An unlimited supply of raw materials with which to work is assured. If one's imagination can visualize an unknown compound whose physical and chemical properties are definite for a particular application, that product can be synthesized. The consumer may not be able to afford the price, but this consideration is dwarfed by the realization that cost is directly dependent upon production volume.

The required tools are available, and in unlimited quantities. The imaginations and ingenuity of chemists and technicians will put them to work.

Discussion

Q. How stable is ethyl aceto acetate?

A. No more stable than ordinary esters,—it will hydrolyze.

Q. Into what?

A. Acetic acid, and perhaps ethyl acetate.

Q. Do any of these products speed up the dissolving of vat colors?

A. I think Cellosolve very definitely will, altho I am also told that it will perhaps increase bleeding during soaping.

Q. B C S Blue, for instance, when dissolved in hydro and caustic, if dyed right away, gives one shade, while if allowed to stand for about 15 minutes, gives a heavier shade. Would any of these products remedy this?

A. Cellosolve would be interesting. I have been told that a solvent now exists which eliminates the use of caustic with vats.

Q. When you say "solvent for vats," do you mean one solvent for all vats?

A. No, it is limited to certain ones, but I don't know which class.

Q. Is there available a record of any experience on Dioxan as a solvent for vat colors?

A. I don't believe there is. I have talked with one man about it, but he wouldn't say much, altho he did say that he was able to dye certain reduced dyes without the alkaline medium. Whether or not this is so, I cannot say, but he states it to be a fact. The ideal solvent would be one that would dissolve all vats.

Q. Is ethylene dichloride corrosive?

A. It's about the least corrosive. It is also relatively non-toxic.

Q. Did you mention butyl cellosolve as having emulsifying properties?

A. Not emulsifying,—coupling properties. It is soluble in water and oil and renders two immiscible liquids mutually soluble.

Q. Is butyl cellosolve a solvent for soaps and sulfonated oils?

A. Yes. The addition of small amounts of butyl cellosolve to an oil which is hard to emulsify will disperse it very rapidly.

Q. How about mineral oils?

A. Yes, mineral or vegetable.

FEBRUARY MEETING, NEW YORK SECTION

The regular monthly meeting of the New York Section of the American Association of Textile Chemists and colorists convened at eight-five o'clock at the Chemists' Club, February 24, 1933, Henry F. Herrmann, Chairman of the Section, presiding.

. . . Following the routine business of the Section, the technical program proceeded as follows:

Chairman Herrmann: It gives me very great pleasure to introduce the first speaker of the evening who is going to talk upon a subject that has been talked about more in the last twelve months probably than any other that I could mention offhand, and that is, "Modern Wetting, Scouring and Dyeing Agents." I take great pleasure in introducing Mr. W. W. Bray, of the Technical Staff of Procter & Gamble.

Mr. Bray: (Applause)

. . . Mr. Bray presented his prepared paper . . . (Applause).

Modern Wetting, Scouring and Dyeing Agents*

By **W. W. BRAY**
Director of Textile & Laundry Research
The Procter & Gamble Co.

IT would hardly be wise to tell a man caught in a hard rain that water is not a good wetting agent. Yet the fact is that in most textile processing, water does not wet out fibers or fabrics quickly and thoroughly. Water needs help in speeding up this function. Consequently there have been developed many types of substances known as wetting agents.

The oldest, best known and most widely used wetting agent is soap in its various forms and types. Because soap is so often used primarily for other purposes, such as degumming, scouring and the like, its wetting power is often lost sight of. However, a well chosen soap is an extraordinarily effective wetting agent for all types of fibers and under a variety of conditions. On a basis of performance or cost, it is hard to beat.

Great improvements in textile soaps have been made in recent years. Their quality and purity have been raised

*Presented at February Meeting, N. Y. Section.

to high levels. Uniformity and convenience of use have been greatly increased by the replacement of solid and, to some extent, bar soaps by smooth, thinly flaked products. Special soaps, especially commercial sodium oleate, have been developed to fit definite textile needs. As a result, a great many objections offered to soap in the past have been entirely overcome. For example, rinsing has been greatly improved by the widespread use of the low titer oleate, while manufacturing skill has overcome any tendency to go rancid.

However, compounds classed as soap are decomposed by acids and converted to insoluble, sticky curds by hard water or other metal salts. Hence they cannot be used for wetting or dyeing in acid media, while in hard waters the ill effects of the so-called lime soaps are difficult to overcome.

Attempts to make up for these deficiencies in the application of soaps have resulted in the development of specialized wetting and dyeing assistants, the various types of sulfonated oils and alkylated naphthalene sulfonates. These products are more or less stable to acids and metal ions. Also they are effective wetting and penetrating agents. However, for lack of detergency or various other reasons, they cannot replace soap to any extent where it can be used.

The need for greater stability toward acids and hard water and the desirability of combining the wetting, dyeing and scouring functions in one product for universal use have led to the development of an entirely new class of compounds. These compounds are the fatty alcohol sulfates, the most important member of which is called, for simplicity, Gardinol WA.

The fatty alcohol sulfates are half sulfuric acid esters of the fatty alcohols. Thus they are sharply differentiated from sulfonated products such as sulfonated aromatics and sulfonated oils. The former are true sulfonates with a quite different chemical structure. In the latter the acid is linked to the hydroxyl group or the double bond in the center of the hydrocarbon chain. In Gardinol WA the ester linkage takes place thru the alcohol hydroxyl group at the end of the chain. This fact probably explains the powerful detergent action of this product.

The properties of Gardinol WA are most impressive, but since they have been widely discussed, I shall only tabulate them briefly.

1. Chemical stability sufficient to make it more than satisfactory in textile processes involving
   a. Acids, even at the boil
   b. Alkalis, even at the boil
   c. Hardness of any natural water
   d. Salts of many commonly used metals
   e. Concentrated NaCl and Glauber's salt solutions
   f. Conditions favorable to oxidation and rancidity
2. First class wetting and penetrating ability.
3. Excellent dye leveling action.
4. Extremely powerful detergent action.
5. Rapid and complete solubility.
6. Chemical neutrality—solutions have pH near 7.

These characteristics of Gardinol are creating a very substantial place for it in textile processing. In the short time it has been on the market it has made rapid strides toward general acceptance and advantageous usage in widely varied types of processes. Some of its striking performances can be classified under headings already well known—wetting, scouring and dye leveling. Other performances are distinctive to Gardinol and depend directly on its unique properties.

Gardinol as a Wetting Agent

A practical illustration of Gardinol's effect in this respect is in the desizing of cotton and rayon fabrics before kiering. The addition of a few ounces of Gardinol per hundred gallons of malting or desizing liquor establishes efficient wetting conditions in the slightly acid medium needed to promote the activity of the desizing agent. Complete wetting at this point, of course, extends its benefits into the kier itself, promoting more rapid and more uniform boiling out.

Wetting out is also an important part of dyeing. It may or may not be a primary wetting out, because the material to be dyed often comes to this process in a wet condition. Nevertheless a reduction of interfacial tension between dye liquor and the fibers is necessary for the successful penetration and application of the dyestuff.

Perhaps the most striking illustration of Gardinol's powerful wetting and penetrating ability is the recent experience of a mill which reworked tailors' clippings into usable yarn. Customarily these clippings were garnetted, dyed and respun. Although high losses of short ends were suffered during dyeing, the mill found it necessary to pick the clippings first in order to get proper penetration of dyestuffs.

Comparative dyeings were made:

a. Without any penetrating assistant
b. With a sulfonated naphthalene product
c. With Gardinol WA

In the first case the results were not at all satisfactory. A mere surface dyeing was obtained. The dyestuff failed to penetrate through the yarns of the clippings. With the sulfonated naphthalene penetrant, the results were only slightly better than the first trial.

The dyeing with Gardinol, however, was everything that could be desired. The clippings were not only uniformly dyed throughout, but they were distinctly more lofty and in far better condition for picking. This example is of particular interest since it demonstrates both the superior wetting and penetrating power of Gardinol

and its ability to work efficiently under conditions, in this case the acid dye bath, which render most penetrants partially or wholly useless.

Gardinol has found extensive and helpful application in all sorts of dyeing jobs. Its value is especially apparent in the difficult cases. Where yarns are closely twisted, tightly packed, or in other ways unusually resistant to penetration and circulation of dye liquor, Gardinol can be of great help. In package dyeing, whether or not in pressure machines, two ounces of the WA Double Powder per 100 pounds of yarn evens up the circulation and produces a well penetrated rather than a surface deposited dyeing. In the hosiery dyebath a fraction of 1% Gardinol carries the dyestuff into seams and heels far more quickly and evenly than previously used assistants.

Gardinol as a Scouring Agent

The powerful emulsifying action of Gardinol makes it very helpful during the degumming of silk under various conditions. Gardinol does not hydrolyze, it yields no alkalinity in solution and so takes no part in the degumming reaction itself. For this very reason it maintains its scouring power to the end of the operation and holds the soaking oils in complete emulsion. It exerts a strong protective action against the formation of oil and lime soap spots, which are so troublesome both on piece goods and hosiery.

In the hosiery boil-off, spotted hose are probably the greatest difficulty encountered. Here, too, the percentage of degumming agent is lower than in any other form of degumming. The tendency to form spots is greater and the need for protection against them is correspondingly increased. Approximately ¼% Gardinol on the weight of hose affords this protection in hard or soft water. Moreover, in the single bath process, Gardinol contributes to the firm crisp handle now desired in the lighter weights of hosiery.

In connection with silk degumming, Gardinol has found an important use as an aid to thorough rinsing. Applied in small quantities during the rinsing of piece goods, it prevents the formation of lime soap specks, and helps rinse out the soap which is strongly absorbed by the silk. Thus it leaves the silk in better condition for the absorption of weighting liquors. Also such treatment with Gardinol removes more completely the residual tints in the silk, especially from lots boiled off in the second, third or fourth strips, and so is an excellent preparation for bleaching. The special value of Gardinol here is that it can be allowed to remain in the goods with actual benefit in later processes.

In its application to rayon scouring Gardinal simplifies greatly the problems connected with the one-bath scouring process. One of the worst of these has been the hardness of the water. Many rayon dyehouses are located in the so-called soft water sections where the water runs 2, 3, or 4 grains in harness. This is often considered not sufficient to justify a zeolite softening installation. Nevertheless it is sufficient sometimes to cause a great deal of trouble in scouring and dyeing.

With Gardinol no insoluble curds form in hard water. No greater quantities of the product are necessary than in zero soft water. Moreover neither oxidizing agents nor reducing agents affect the efficiency of Gardinol. Indeed the presence of Gardinol makes possible an efficiency of bleaching previously unattainable. A distinctly better white is obtained from a given quantity of hypochlorite or peroxide.

Gardinol as a Dye Leveler

Besides the ability to promote wetting and penetration a dye assistant must possess effective dispersing and leveling action. By dispersing action is meant the ability to prevent separation of particles of dyestuff either as scum or as a film on the cloth. By leveling is meant the ability to prevent grabbing or local absorption of dyestuff and to help produce an even shade throughout the material. Gardinol possesses these qualities to the higher degree and is being accepted universally and used in all sorts of dyeings.

Some of its most interesting effects are shown on union goods in matching shades and eliminating blotches. Soon after Gardinol was introduced, this was proved to the complete satisfaction of the dyer and management of one of the largest hosiery mills. The bulk of the work in this dyehouse is cotton-topped silk hose of service weight. With such hose it has always been a major problem to dye the cotton evenly and match its shade to that of the silk. Reasonably good results had been obtained by prolonged boiling with an excess of dyeing oil but the difficulty had never been satisfactorily overcome.

The exceptional leveling power of Gardinol furnished an easy solution to this problem. One-fourth per cent Gardinol added at the start of dyeing completely eliminated blotches in the cotton tops and greatly reduced the difficulty of matching the shades of the two fibers. Gardinol has helped many other hosiery dyers to overcome this same problem.

In dyeing silk piece goods, weighted or unweighted, Gardinol's combination of properties is proving especially helpful. Because it is unaffected by hard water, it eliminates this still common cause of spots and cloudy dyeing. In the average case an ounce of Gardinol per piece of silk in the dye bath produces brighter and more even colors, reduces the surface haze of chafing and leaves a characteristic desirable hand. Gardinol insures better dyeing at a cost equal to or lower than the usual dyeing oils.

In logwood dyeing, too, Gardinol promises substantial improvement. According to the method used in one large dyehouse, six ounces of Gardinol were used per piece in the logwood bath. The thorough rinsing between dyeing and nitriting formerly necessary was practically eliminated. Only a brief wash was given to remove excessive or surface dyestuff. Even more important than this saving in water and time, Gardinol eliminates any danger of streaks and cloudiness.

The Distinctive Behavior of Gardinol

A great many extremely interesting examples have arisen in which the distinctive properties of Gardinol are plainly apparent—properties possessed by Gardinol and not by other textile assistants.

One of the most unusual uses of Gardinol is its application in the silicate bath given as the last step in tin weighting. Experienced silk weighters know that when the silicate bath gets cloudy, the silk pieces are likely to be streaked, cloudy, or cracked, due to a surface deposit of silica. Hence when cloudiness appears in the silicate bath, the only thing to do is to drop the bath and make up a fresh one.

Several large piece dye works have gained both protection and economy by using Gardinol to delay this development of cloudiness. A small amount of Gardinol is placed in the fresh silicate bath and further slight additions are made to keep a light suds on the bath.

As a result, the silicate bath stays clear longer and the following advantages are observed:

1. 25% more pieces can be treated in the bath before it becomes too cloudy to use.

2. The silicate is more evenly applied.

3. There are no streaks or cloudiness, breaks or cracks on fabrics such as have previously been caused by silica deposits.

4. There is less tendency to chafe and the goods have a softer handle.

The fact that Gardinol is chemically neutral has very important implications in many processes dealing with alkali-sensitive fibers. This has been found of particular value in processes of stripping and redyeing. In the past it has been customary to do this in the presence of alkaline materials which usually depreciated the product more or less. Gardinol, combining the necessary wetting, penetrating and dye-levelling properties with absolute neutrality, makes possible the reworking of silks and wools with practically no depreciation in these fibers. This is especially obvious in the case of silk hosiery, when the prolonged working is very likely to develop sleaziness or chafing.

Gardinol is upsetting textile traditions everywhere. It makes possible methods of operation hitherto unknown—eliminations and combinations of processes, new effects and qualities of finish. Gardinol is rapidly finding a place in the textile industry and is becoming a stimulating force for the better wet processing of textiles.

Discussion

Chairman Herrmann: Gentlemen, you have heard Mr. Bray's very instructive presentation. I believe the most instuctive portion of these lectures usually develops during the question period. I forgot to ask Mr. Bray whether he would be willing to stand up under a barrage.

Mr. Bray: I would be glad to try.

Chairman Herrmann: If you have any questions, let's have them now. I may preempt the opportunity and ask one myself.

Mr. Bray, you mentioned that in the dyeing of union goods Gardinol exhibited a remarkable leveling property which from a pure color concept is a little difficult to account for because usually in union dyeing formulae one so proportions the dyes which go onto the vegetable fiber and those that go onto the animal fibers so as to have the desired union effect, and it is rather difficult for a person not acquainted with this article to understand just how this leveling materializes, whether the cotton color develops affinity for the animal fiber or the acid dye develops affinity for the cotton fiber, which would be necessary in order to get a reapportionment of the absorption.

Mr. Bray: I quite agree with what you say, that it is probably the desirable or ideal condition to have the exact relationships of those dyes worked out but, simply as a practical observation, we have found that where difficulty is encountered in union goods in obtaining a match, for whatever reason it may be, the dyeing with this type of agent has brought out distinctly more rapid dyeing and better leveling.

Mr. Zisman: Perhaps I can help Mr. Bray to explain that point that he brought out.

I think what Mr. Bray probably has in mind or has seen others experience is this: owing to the fact that Gardinol is supposed to be such a wonderful leveler, when the dyer looks at his match he doesn't see three or four different shades in the cotton, he sees one, and it naturally helps him to quickly match the shade and get a good union. Possibly that may account in an indirect way for its helping the matching.

That is about all there is to it. I don't think that Gardinol in any way causes colors which would ordinarily not go onto cotton to go onto cotton, or vice versa. I don't think that is so at all. It is just a matter of helping the leveling and helping the dyer to see the shade better, more correctly, to say the least.

Chairman Herrmann: I might add, from personal experience, that a lot of union material is apt to be thick.

It is built up thick, with a heavy cotton warp or twist in the back, and it is rather difficult to get a uniform penetration of that material, and the tendency toward a "toppy" color—that is, for the color that just sits on the hard, top spots—is always there, and any agent that would carry that color would, of course, create that effect.

I was just wondering whether the Gardinol was supposed to actually alter the distribution of the dyes from a chemical standpoint.

Mr. Bray: We haven't observed any altering in that respect. It seems to us that it is simply the way Mr. Zisman explained: it assists the dyestuff that is intended for a given fiber to go on that fiber.

Mr. Guiterman: I didn't hear your paper but I wondered if Gardinol had any application in printing.

Mr. Bray: The most likely application that we have found so far is in washing the print afterwards. We have found in a number of cases that it is very effective at that stage of the process.

It can be used in relatively small quantities and its use is therefore economical. Besides that, there is considerable evidence that it produces clearer backgrounds and, in the case of dyestuffs that are at all doubtful, it makes possible a distinct reduction in bleeding.

So far as its possible use in printing paste is concerned, I am not prepared to state.

Mr. George Baxter: Mr. Bray, has there been any use of it on viscose or acetate fibers, or a combination of the two?

Mr. Bray: It has been used on various viscose rayons and while I don't recall specific examples of its use on acetate I know that trials have been conducted in scouring and dyeing acetates both alone and in mixtures.

Did you have any specific thing in mind?

Mr. Baxter: I was just wondering whether you had made any trials (and if so whether they had shown any results similar to the union goods that you spoke of) of the viscose and acetate fabrics, and if there were any leveling properties in those fabrics.

Mr. Bray: We found it an excellent means of pasting and preparing the dispersion of acetate dyestuffs, and it has been used in dyeing various unions in which the acetate rayon was present, with distinctly beneficial results in respect to leveling.

Mr. Shattuck: Mr. Bray, you mention the stability of Gardinol in the presence of ordinary hard water. I wonder just what its action would be in the presence of calcium chloride solutions. Have you worked on that?

Mr. Bray: Oh, yes. We look upon calcium chloride as substantially an equivalent of the hardness in water, or a part of the hardness. The majority of hardness is calcium and magnesium salts, and in making up artificial hard water we combine calcium and magnesium chlorides in varying proportions, and we always use the calcium chloride in tests to indicate the stability of any compound. Gardinol has a very good stability toward calcium chloride itself.

Mr. Shattuck: I see. If you took a gram of Gardinol and dissolved in 100 cc. of water, how much calcium chloride would you say would be necessary in that solution to throw your Gardinol out or precipitate, or what you will?

Mr. Bray: That would depend largely upon the temperature. The calcium Gardinol compound is soluble to a certain extent, depending upon the temperature. By that I mean the solubility will increase considerably with increasing temperature. At very low temperatures, a relatively small amount of calcium chloride would produce a form of precipitate. In lukewarm water or warmer the tolerance is considerably extended.

You are asking about a one per cent solution and that makes it a hypothetical case because that concentration of Gardinol would rarely if ever be actually used. Figuring it in terms of grains of calcium chloride per gallon, I should say that it would stand at lukewarm temperature or above a hardness from fifty to seventy-five grains. That is an estimate because I don't have data on that exact concentration.

Mr. Shattuck: If you reach a point where you get a precipitate, I mean, where you throw your Gardinol out of solution, is that a graining action so-called or do you actually get a reaction between your lime and your Gardinol, forming a calcium soap, we will say?

Mr. Bray: It is not a graining action. The calcium replaces the sodium in the Gardinol. If a separation takes place it is a simple crystallization due to supersaturation.

Usually, it takes a considerable while for the precipitate to form under conditions in which it is not soluble. For example, you can take a Gardinol solution and really super-saturate it with respect to calcium and maintain a clear solution for a considerable period of time. Then a gradual formation of the precipitate takes place. That extends the tolerance of the products from a practical point of view because ordinarily in scouring processes we need only a few minutes in order to complete the operation. While there is hardly any conceivable situation in practical scouring under which the calcium salt of Gardinol would become insoluble, if such a situation should arise, the lag in the crystallization would give ample time, we believe, for that particular bath to be removed without any precipitation.

A further point is that the precipitate itself when it does form is without the troublesome qualities of a lime soap precipitate. It is not the voluminous sticky curd

that forms between hard water and soap. It is a very fine and very light crystalline type of thing.

Mr. Shattuck: Thank you.

Mr. Geber: I should like to know if there are any advantages in using Gardinol where one has very soft water.

Mr. Bray: Yes, in a great many applications. In fact, most of the instances that I referred to were in either relatively soft or zeolite-treated water. Such things as its general wetting properties, its penetrating action, and many scouring applications take place in practically zero soft water.

The hardness end of it is important, and yet today the textile mills that have really hard water—that is, anywhere from five grains up—are relatively scarce. As I mentioned, two and three grains often give some trouble but I think the majority of textile mills work with still lower hardness or zeolite-treated water.

The majority of the Gardinol being used is used in soft water. I mean by that two grains or less.

Chairman Herrmann: Have we any more questions?

Mr. Stulz: Has Gardinol any soap stability and can it be used continuously?

Mr. Bray: I don't know that I quite get what you mean.

Mr. Stulz: In other words, take the scouring. Can it be used for any definite period or any number of successive runs?

Mr. Bray: Yes. It can be used for, you might say, an indefinite period, if your operation is such that you can re-use it. As a matter of fact, it appears particularly efficient under scouring conditions in which the bath is re-used. In other words, instead of batch scouring, a sort of continuous scouring process, such as is used in raw wool scouring, is particularly well adapted to the use of Gardinol.

Mr. Stulz: Well, in scouring, where they use wool oils and different materials—where they use soap for scouring—is Gardinol practical as compared with competitive materials such as soaps and other oils?

Mr. Bray: In some cases it has proven distinctly practical and economical. I can't make too broad a statement there because we don't know all about it yet.

Mr. Stulz: In spite of the low price of soap, as an illustration?

Mr. Bray: Yes, in a great many cases.

Mr. Stulz: Has it been proven more practical?

Mr. Bray: It has proven thoroughly practical—let me put it that way. In other words, in many cases we have been able to produce efficient scouring with distinct advantages at scouring costs which are comparable.

I think as we learn more about it and extend its application, work out more fully the details of its use, its application will be correspondingly extended.

Mr. Freedman: Mr. Bray, I should like to ask a question. Has its use been studied in connection with the inhibiting action, if any, on the crocking of dyestuffs?

Mr. Bray: Do you mean in washing, that is, laundering?

Mr. Freedman: First, in the scouring action in the mill and, later on, in the laundering process. So far as the dyehouse is concerned, has any action been studied in connection with the aniline blacks?

Mr. Bray: I don't know of any specific application in that connection.

As far as the laundering is concerned, it is being given fairly intensive study, but we haven't yet worked out fully the details of how it should be used there. There is a great deal of promise, for example, for methods of laundering which would wash fabrics, with dyestuffs that might bleed, in solutions either mildly acid or with more or less concentrated salt solutions, in an attempt to prevent the dyestuffs from being loosened from the cloth. Some of the results are very promising but as I say we haven't worked out the details of it thoroughly as yet.

Chairman Herrmann: Are there any other questions?

Mr. Sokolinski: In connection with the comparative wetting out or penetrating properties, is Gardinol, compared, we will say, pound for pound, with a highly sulfonated oil, about proportionate in cost? I mean, how would it work out there? I don't know the cost of Gardinol. For example, if it should be twenty-five cents a pound, would a pound of that be equivalent we will say to three or four pounds of highly sulfonated oil which would be approximately the same in cost?

Mr. Bray: We ordinarily have to work on a comparative cost basis. In some cases, a greater expense can be allowed because of the distinctly valuable properties that are obtained. In other cases, it has to be pretty much a cost proposition and it works out surprisingly well in a great many applications of that kind.

Chairman Herrmann: Some weeks ago a gentleman went down to Washington and called on our good friend, Mr. William Appel. This gentleman so impressed Mr. Appel with his knowledge of the theory of the standardization of colors by a unique method that Mr. Appel wrote us and suggested that we invite the gentleman to call on us. So it is with great pleasure that I introduce Dr. Paul Dieterle, who is going to expound his new system of standardizing colors.

Dr. Dieterle! (Applause).

(*See Next Page*)

ANNUAL MEETING

IT was definitely voted at the last Council meeting, to hold the general meeting of the Association in Chicago, on Friday and Saturday, September 8th and 9th.

Proceedings of the American Association of Textile Chemists and Colorists

A System of Standardizing Colors*

By **D. P. DIETERLE**
Louis Dejonge & Co.

EACH shade of color is determined by its content of the primary colors Red, Yellow and Blue. Therefore any shade can be expressed by the general formula $R_xY_yB_z$, in which R red, Y yellow, B blue, x the percentage of red, y the percentage of yellow and z the percentage of blue. The sum of x y z must therefore always be 100.

The three elementary colors are applied at corners of a triangle and marked with the following formulas:

pure Red R_{100}
pure Yellow Y_{100}
pure Blue B_{100}

The various shadings from Red to Yellow of the formula $R_xY_yB_o$ are situated on the side RY of the triangle, the shadings from Yellow to Blue of the formula $R_oY_yB_z$ on the side YB and the shadings from Blue to Red of the formula $R_xY_oB_z$ on the side BR. By this way, the pure hues are obtained. They can be called binary shades, as each one is formed by the mixture of two of the primary colors.

If each side of the triangle is divided into the same number of equal parts, variations of hues are obtained, in which each hue differs from the two adjoining ones by the same increase and decrease of the two fundamental colors, of which the three hues are composed. Dividing e. g. each triangle side into 10 parts, the increase and decrease is 10%. If now the points of the same amount of Red, Yellow or Blue are connected by straight lines, the intersections of these lines correspond to mixtures of the three fundamental colors and each mixture differs from the adjoining ones by the same increase and decrease of two of the fundamental colors, while the amount of the third fundamental color remains constant. By this way, series of unvaried quantity of Red, Yellow or Blue are obtained. Shades of the same amount of red are on lines parallel to the triangle side Yellow-Blue, shades of the same amount of Yellow on lines parallel to the Blue-Red side and mixtures of the same amount of Red on lines parallel to the Yellow-Blue side.

The shades produced by the mixtures of the three fundamental colors are dull and can be called ternary shades.

A shade is not only determined by the proportion of primary colors of which it is composed, but also by the amount of reflected white light. The decrease of reflection of which light corresponds to an increase in depth or value of a shade. Therefore we select for our normal scale the three fundamental colors of such a depth or value, that their mixture in equal parts does not reflect white light, that is to say produces a black. We give to the shades of the normal scale the prefix 100 and are then able to coordinate the shades of different values by different prefixes, e. g. 50, 25, 12, 5, etc.

The whole color system can then be represented by a triangular prisme, in which the different crosscuts represent the values.

Black, or in a lower value, a neutral grey is obtained by the mixture of the three primary colors. Actually we have to mix three pigments or dyes, representing the three primary colors in different proportions because of their differences in value. As it is convenient to represent graphically the color triangle as an equilateral one, it is preferable to bring firstly the three pigments or dyes used to the same value. In the case of pigments, this can be done by cutting them with white or in the case of dyes by varying the concentration of their solution.

Each ternary shade can be regarded as a mixture of a primary color or a binary shade with grey. To express this by a formula, we have only to take the smallest amount, in which one of the primary colors is present in the mixture, deduce the same amount from the two other primary colors and the remainder gives us the primary or binary color, from which the shade in question can be obtained by addition of grey. I will make this clear by the following two examples:

$$nR_{60}Y_{20}B_{20}=n(R_{40}+R_{20}Y_{20}B_{20})=\frac{4n}{10}R_{100}+\frac{6n}{10}R_{33\,1-3}Y_{33\,1-3}B_{33\,1-3}$$

$$nR_{45}Y_{45}B_{10}=n(R_{35}Y_{35}+R_{10}Y_{10}B_{10})=\frac{7nR_{50}Y_{50}}{10}+\frac{3n}{10}R_{33\,1-3}Y_{33\,1-3}B_{33\,1-3}$$

For the mixtures of colors we have the following rules:

By the mixtures of two colors we can obtain all shades, that are on a straight line between the two colors used. So we can obtain by the mixture of R_{100} with $Y_{50}B_{50}$ the shades $R_{80}Y_{10}B_{10}$, $R_{60}Y_{20}B_{20}$, $R_{40}Y_{30}B_{30}$, $R_{20}Y_{40}B_{40}$; by the mixture of $R_{40}Y_{60}$ with $Y_{60}B_{40}$ the shades $R_{30}Y_{60}B_{10}$, $R_{20}Y_{60}B_{20}$ and $R_{10}Y_{60}B_{30}$; by mixing $R_{20}Y_{70}B_{10}$ with $R_{50}Y_{10}B_{40}$ the shades $R_{30}Y_{50}B_{20}$ and $R_{40}Y_{30}B_{30}$. Also the quantities of the components, which are necessary to obtain a given shade can be read directly from the graphic representation, as they are inversely proportional to the distances of the components from the desired shade. For instance $^2/_3$ $R_{20}Y_{70}B_{10}$ and $^1/_3$ $R_{50}Y_{10}B_{40}$ give the shade $R_{30}Y_{50}B_{20}$.

By the mixture of three colors all the shades can be obtained, that are within a triangle, whose angles are determined by the position of the three colors used. Also

*Presented at February Meeting, N. Y. Section.

here the proportions of the quantities of the three colors necessary to obtain a given shade can be determined by a graphical method. If we want to obtain a shade "d" by the mixture of the three colors a, b and c, we draw through "d" three lines parallel to the 3 sides of the triangle and we design their intersections with the side bc as a′ and a″, with the side ac with b′ and b″ and with the side ab as c′ and c″. The proportions in which we have to use the three components a, b and c are then given by the formula:

$$a : b : c = da' + da'' : db' + db'' : dc' + dc''.$$

I think that I have bothered you long enough with theoretical and mathematical deductions and I will show you now the practical application of my color system. I have based my experimental work on wool dyeings, as these, due to the almost complete exhaustion of the dye baths, show the most clearly the quantitative relations. As probably no manufactured dyestuff fulfills the physical requirements of a pure Red, Yellow or Blue and as I will show later on, this is not necessary for their use as standards, I selected three dyestuffs that came the nearest to the 3 following requirements:

(1) The almost complete exhaustion of the dye bath.
(2) Good equalizing quality.
(3) Good light fastness.

Under these considerations I selected among the wool dyes of the Berlin Aniline the three following ones:

(1) Guinea fast red 2 R
(2) Guinea fast yellow 3 G
(3) Guinea light blue SE.

Firstly I determined their relative strength, so that a mixture of equal volumes of their solution gave a neutral grey. This was obtained by solutions of

0.495 gr. of Guinea fast red 2R per liter
1.3 gr. of Guinea fast yellow 3G per liter.
1.0 gr. of Guinea light blue SE per liter.

Dyeings with 25 cc. of these solutions on 2.5 gr. of wool gave the shades R_{100}. Y_{100} and B_{100} of the 25 scale. Then the dyeings of the various mixtures were made, varying always by 10% but so that the sum of the cc. used was always 25 cc. Thus I obtained this color triangle, which contains the 3 primary colors, 27 binary and 36 ternary shades. Later I completed this scheme by the 5% steps, obtaining a triangle which contained besides the 3 primary colors, 57 binary and 171 ternary shades. Further a color triangle in steps fom 10 to 10% has been dyed in the 12½ scale. Also some shades in the 50 and 100 scales were dyed.

Now the position in my color system of some wool dyes of the Berlin Aniline were determined. I will mention only a few of them:

Mandarin G	0.35%	25 $R_{28}Y_{72}$
Eosamin G	0.4 %	25 $R_{95}Y_{5}$
Guinea red 4R	0.4 %	35 $9_{99}B_{1}$.

As you see, these dyes correspond to binary shades of my scale.

Later the positions of some dyes were determined, who by the purity of their shade are situated outside of my scale. To determine their position, they were mixed with one or two of my primary colors until the shade obtained corresponded to a shade on the borders of my triangle. The quantity of dye used for shading was introduced with a negative value into the formula and the formula brought up again to the sum of 100. I will give here some examples for a better understanding.

Guinea fast red 2BL 0.5%, 25 $R_{97}B_{3}—Y_{6}$ or
0.53%, 25$R_{103\cdot2}B_{3\cdot2}—Y_{6\cdot4}$
Eosamin B 0.35%, 25 $R_{100}—Y_{4}—B_{1}$ or
0.37%, 25$R_{103}.3—Y_{4}.3—B_{1}$

To give the position of these dyes, I had to extend my original color triangle for the negative values and those situated above 100.

The determination of the position of dyestuffs, which correspond to ternary shades had not been carried out, due to the lack of time.

By using this scheme the colorist has now not only the possibility of expressing a given shade by a simple formula but also to determine, what shades can be obtained by a mixture of given dyes and to calculate, how much of each dye he has to use.

I know that my color system is still very far from being completed, but if anybody among you would be interested to do some further work on it I would be very glad to give him all the information that he might require as I have no opportunity to do some experimental work on dyeing. As soon as I will have some time I will try to work out a similar system based on pigments, as this would be in nearer connection with my present occupation.

Discussion

Chairman Herrmann: Have any of you questions to ask Dr. Dieterle?

I was wondering, Doctor, whether it was possible, with the present development of your color scheme, to have a dyer work out a simple scheme whereby he could match any number of staple shades that could be produced, say, with three standard colors. We will take, for instance, the average piece goods mill or carpet yarn dyeing mill that standardizes on Yellow 2G and Fast Red BL and Sapphire Blue. If a dyer can take those three colors and with them produce possibly eight hundred and fifty standard shades which are part of his regular spectrum that he is called upon to reproduce, do you think it would be possible for him to take a union shade and just lay it in there somewhere and then figure out the formula in percentage of color?

Dr. Dieterle: What should be created, firstly, to work

out this system is not just one color triangle, but a series of triangles of different values.

When, this has been completed you will find nearly every shade, as nearly as in any actual existing color system, and you will immediately find that such-and-such a per cent of the dyes you have on hand will correspond to a dye that is in this and this shade, in this and this strength, etc. You can calculate it to another shade and to another strength. By that means, you can immediately get what you need for shading it, you can get the desired hue.

Chairman Herrmann: And if the sample that you happened to be given were to behave differently in artificial light then you would have to start from a different angle, I suppose?

Dr. Dieterle: Yes, of course, if we have a shade that changes very much in yellow light.

Chairman Herrmann: That is a practical consideration. A dyer never knows when he is given a sample how the sample was produced originally.

Dr. Dieterle: Yes.

Chairman Herrmann: One man uses yellow and red, another man uses orange as the orange component of the combination, and it makes a vast difference as you undoubtedly know.

Dr. Dieterle: Yes.

Chairman Herrmann: If you produce a khaki like this (indicating) or brown out of yellow, red, and blue, it is one thing. If you produce it out of orange, red, and blue, its behavior in artificial light is totally different.

Dr. Dieterle: Yes. If you really wanted to do that, you would have to make a completely different color scale for artificial light. Then you could do it. Or with light with the same amount of yellow. In artificial light, what you do is add a certain amount of yellow to it.

Chairman Herrmann: Yes, surely.

Dr. Dieterle: So you change the whole scale to the yellow side. Then, of course, these quantity relations under white light are no longer applicable.

Chairman Herrmann: Are there any more questions?

Mr. Kennedy: If you have a red and want to make a pink with hydrosulfite soap, what do you do?

Chairman Herrmann: He is subtracting color now, instead of adding. (Laughter)

Dr. Dieterle: There is no way of saying in advance what you will get. It depends on the action of your bleaching agent. But, if you have dyed goods and you want to put some other color on top of it, you can predict what you will get.

Chairman Herrmann: In the pigment field, the addition of white is a more exact science than it is in dyeing where the addition of white usually means color destruction; in the use of a white pigment, it is a definite matter of addition.

Dr. Dieterle: Yes, but I don't think that, practically, a dyer will get a certain shade by bleaching out goods that he has dyed.

Chairman Herrmann: No, he always passes way beyond the point and then goes back again. (Laughter).

Dr. Dieterle: Yes.

Chairman Herrmann: Have we any more questions?

Mr. Zisman: May I ask the speaker whether any practical application has ever been made on this yet?

Dr. Dieterle: No. You see, I never had the time to do it. I went completely out of the field of dyeing just one month after I had started this. I started doing something entirely different.

Chairman Herrmann: You are still waiting to build up that prism?

Dr. Dieterle: Yes.

Chairman Herrmann: Well, it is a sizable job. I have seen some of Ostwald's compilations and they are quite terrifying, I mean the amount of work actually done.

Dr. Dieterle: Yes. Of course, it requires a certain amount of work. But, you see, this is an extremely simple system, a system that everybody can understand right away.

Chairman Herrmann: Are there any further questions, gentlemen?

Mr. William A. Kingman: I should like to ask the Doctor if he has done any work with pigments at all as yet?

Dr. Dieterle: I haven't started yet. I have made some preliminary tests but I encountered a great amount of difficulty. Firstly, you can only mix pigments if they have absolutely the same particle size. Otherwise, you get absolutely incorrect results. So I am still working on the preliminary steps with pigments.

Mr. Kingman: Then you will have to wait until they get the ideal pigments (laughter), not the commercial ones.

Dr. Dieterle: Perhaps I will have to make some myself. (Laughter)

Mr. Kingman: You will find that with the addition of any white to reduce the shade, or increase the value, we will say, to make it lighter, the undertone would show up and make an entirely different shade than what you expect.

Dr. Dieterle: Yes. For instance, if I match in one strength my three pigments, that I have, in the scale 100, and I add to the blue, red, and yellow the same amount of white to bring them down to 50, an equal mixture of them will no longer give a grey because by the addition of white, due to their different particle sizes, they have a completely different strength. That is the great difficulty with pigments.

Mr. Kingman: That is why I wondered how far you

had gotten with pigments. I thought you might run into something like that.

Chairman Herrmann: Just a point of information: If you were to select three pigments all of which had a fineness, say, of 300 mesh, would that be sufficient to give uniformity?

Dr. Dieterle: Yes. Probably what I shall have to do is precipitate three dyes on the same base so that I am sure I have three pigments that are of equal size.

Chairman Herrmann: Practically use a pulp instead of the dried color?

Dr. Dieterle: Yes.

Chairman Herrmann: Is there anything else to come before the Section? If not, I will call for a rising vote of thanks to the gentlemen who were kind enough to come and address us this evening, as well as to the Program Committee that labored so hard on our program.

. . . Such a motion was made and seconded, put to a vote and carried . . .

. . . The meeting thereupon adjourned at nine-thirty o'clock . . .

MEETING, PHILADELPHIA SECTION

The fourth meeting of the 1932-1933 season, of the Philadelphia Section was held on Friday, March 24, in the Pennac Capers, Room of the Penn Athletic Club, in Philadelphia.

After the usual informal dinner, served at 7:30 P. M., the Chairman, Mr. Stringfellow, opened the business meeting.

Following the reading and approval of the minutes of the preceding meeting, the Treasurer, Mr. Sullivan, presented a verbal report of the expenditures for this season to date and the present financial status of the section.

Mr. Eugene C. Kneable, Chairman of the Membership Committee, then presented a prepared report regarding the membership of the section, as follows:

	Active	Junior	Associate	Corporate	Total
Present membership	155	8	12	5	180
Membership, May 1, 1932					165
Transferred from the section, May 1, 1932 to date	2				2
Resigned, May 1, 1932, to date	2	1			3
Lost as a result of non-payment of dues, May 1, 1932	6	1			7
Transferred to the section, May 1, 1932, to date	5				5
New members, May 1, 1932, to date	15	1	5	1	22
Applications for membership pending	2	1			3
Female members of the section	4				

The chairman then announced that in the interval since the last meeting he had appointed the following named members as a committee to suggest nominations for elective officers of the section, Messrs. E. B. Martin, H. S. Travis and C. C. Hagelgans.

Mr. Travis then presented the report of this committee, as follows: Chairman, William A. Stringfellow; Vice-Chairman, Robert A. Bruce; Treasurer, Robert E. Sullivan; Secretary, Charles A. Seibert; Section Committee, A. Moody Burt, John T. Gibbon, Robert M. Moore, Donald H. Powers; Councilor, Harold B. Dohner.

The Chairman then read a communication from the National Secretary directing attention to the necessity of electing a representative to serve on the committee to prepare nominations for national officers. This was followed by the election of the section's secretary, Charles A. Seibert, for this purpose.

The Secretary then read a communication addressed to the Chairman, from Dr. Donald H. Powers, Chairman of the Committee for the Technical Program for the Annual Meeting, as follows:

"The Annual Meeting of the American Association of Textile Chemists and Colorists is to be held in Chicago this year, September 15 and 16. We are particularly anxious to have a good technical program at this meeting and we should appreciate it very much if you could send us the names of members of your section that expect to attend this meeting, and possibly give a paper. It may be advisable to point out that a person giving a paper does not necessarily have to attend the meeting.

"Last year three or four papers were read by someone else attending the meeting. Of course, we are particularly anxious to have as large an attendance at this meeting as possible."

The question of where the next meeting of the Section should be held was then discussed and Mr. Charles F. Credo agreed to endeavor to secure the use of the Whitemarsh Valley Country Club and communicate the results to the Chairman of the Arrangements Committee, Mr. Walter G. Hamlen, Jr.

After expressing his personal appreciation to the officers and appointive committees of the Section for the services they had rendered, the Chairman introduced Dr. Robert E. Rose, President of the Association, who expressed his thought regarding the groups composing the membership of the Association in relation to their field of activities in the textile industry.

Mr. Penrhyn Wilson, sales manager for the R. K. Laros Silk Co., of Bethlehem, Pa., then presented a prepared address entitled "Raw Silk and Throwing." He supplemented his address by exhibiting motion pictures illustrating the processing of raw silk as it is done in the plant of the Laros Silk Co. This was followed by a discussion of the address and illustrations.

Following a rising vote of thanks to the guest speakers, the meeting was adjourned at about 10:30 P. M., after which conversation among small groups was maintained until about 11:30 P. M.

Attendance at the dinner, 59, and at the business meeting, 63.

Respectfully submitted,

CHARLES A. SEIBERT, *Secretary*.

AMERICAN
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AN INTERESTING DECISION

CONSIDERABLE interest has been shown by various groups within our industries in the recent decision handed down by the Supreme Court in regard to the Appalachian Coal Case. In the textile industry this decision has been acclaimed with great gusto as a way out for many branches. Some of the more optimistic in the cotton goods field as well as in other branches claim that restrictions on consolidation have been removed and happy days are in sight. Many are studying the decision with the thought in mind that it may be possible for them to take advantage of the apparent opportunity to improve their own status by the organization of cooperative selling units.

The case which came before the Supreme Court involved a group of coal producers, comprising a substantial percentage of the producers in their particular territory but a relative small percentage of the total producers in the country. This group organized a cooperative selling agency which, in brief, distributed the entire production of its members on a fixed commission basis; pro-rated orders among members according to the productive capacity of each; maintained a uniform price, and endeavored to engage in research and to eradicate harmful practices which had developed in the industry to the detriment of all producers.

The Supreme Court's decision, which incidentally reversed the decision of a lower court, is considered by many to be the most liberal interpretation of the Sherman anti-trust law, from a business standpoint, ever given by that body. This is taken by some to forecast probable approval of similar efforts by other industries which may be interpreted as measures adopted for economic self-preservation under extremely trying conditions prevailing in those industries.

It should be remembered, however, that the Court in giving its decision on this case limited itself to the particular facts as presented in this particular case and avoided the rendering of a decision which could be capable of general application. The Sherman Act still states that contracts or combinations in the form of a trust or otherwise in restraint of trade or commerce is illegal. In this connection we should note here that a distinction has always been made between efforts being made to gain as much business as possible under competitive conditions and those efforts which are made to destroy competition. The decision in this case simply means that the particular selling organization in question did not violate the anti-trust laws. It has been also pointed out that the prosecuting case was not adequately presented. The argument has been presented that heretofore it has been generally accepted that any agreement eliminating competition between the parties to the agreement was a violation of the anti-trust laws and that this Appalachian Coals decision has been interpreted as countenancing the regulation of competition within a group representing only a part of an industry, provided the group is subject to unrestrained competition from other members of the industry, and does not possess the power to establish a monopoly price.

It appears obvious that the Supreme Court, while opening the way for intelligent self-regulation by industry in general to a greater extent than has ever before been possible, is prepared to consider each subsequent case of like character on its individual merits.

Producers' organizations have not been opposed by the government as long as they have been within the bounds of the limitations of the anti-trust laws. We do not believe that the Appalachain decision has changed the existing laws at all but merely has interpreted it more liberally than heretofore.

We do not advise that any undue optimism should arise from this decision as the liberalism indicated by this interpretation may be regarded as conservative six months from now.

If more liberal laws concerning trusts and group associations are desired the obvious thing to do is to change the existing laws. The general feeling has been against the formation of trusts or other types of monopolies and that is why we have the laws that we do have.

Awarded A. I. C. Medal

The medal of The American Institute of Chemists, presented annually for outstanding service to chemistry in America, has been awarded this year to Dr. H. C. Sherman, head of the department of chemistry at Columbia University, according to an announcement made recently by President Henry G. Knight from the Institute's office at 233 Broadway. The award is made in recognition of Dr. Sherman's food researches, and his services to the profession through the training of chemists.

George W. Kuchler

George W. Kuchler, for many years in charge of Peroxygen sales of the Roessler & Hasslacher Chemical Company, now the R. & H. Chemical Department of E. I. du Pont de Nemours & Co., and widely known in the textile and chemical industries, died February 10 at Houston, Texas.

Mr. Kuchler was born in New York City in 1864. He attended school in Giessen, Germany, and returned to the United States at the age of seventeen. He was with Rossler & Hasslacher Chemical Company since 1890 and shortly after going with that company was placed in charge of Peroxygen sales. He retired in June 1932 after forty-two years of service.

Textile Exhibition and Style Show

Dr. Thomas Nelson, Dean of the Textile School, North Carolina State College, announced today that the Textile Exhibition and Style Show will be held Thursday, April 27th.

Young ladies representing the home economics departments of the following North Carolina colleges, will participate: Meredith College, Raleigh; Peace Junior College, Raleigh; Saint Mary's, Raleigh; East Carolina Teachers College, Greenville; Catawba College, Salisbury; Louisburg College, Louisburg; Elon College, Elon; Flora McDonald College, Red Springs.

The seventy-eight young ladies who will participate in this Style Show will model garments which they have made as a part of their classwork, from fabrics designed and woven in the Textile School by students, from yarns spun and dyed by them.

New Du Pont Color

The Dyestuffs Division of E. I. du Pont de Nemours & Company has just announced the development of Pontamine Fast Orange RGL, a direct color which is expected to find its greatest use in dyeing cotton and rayon piece goods and yarns for tapestries, draperies and similar materials requiring exceptional light fastness.

The new dye differs chemically from other offerings and in shade is between Pontamine Fast Orange 2GL and Pontamine Fast Brown 4GL. It is said to be very fast to light, perspiration and washing, and may be dyed on cotton and rayon in all forms.

Opens Consulting Offices

Herbert R. Mauersberger, formerly of Cox, Fuller & Mauersberger and more recently with the Celanese Corporation of America, has opened offices as a textile consultant at the Eagle Building, 305 Washington St., Brooklyn, N. Y. He is prepared to solve all problems relating to the spinning, weaving, designing, analyzing, finishing and dyeing of textile yarns and fabrics. He also announces that he can give technical assistance in claims, disputes, arbitrations and court cases.

Beard Associated with Haveg

John Beard, formerly with the Sharples Specialty Company of Philadelphia is now associated with the Haveg Corporation of Newark, Delaware. Mr. Beard graduated from Lehigh University in 1920 and since that time has been engaged in technical sales work.

The Haveg Corporation is an associate of the Continental-Diamond Fiber Company also at Newark, Delaware. The Haveg Corporation has just completed a new plant for the manufacture of corrosion resistant chemical equipment.

Haveg was developed in Germany in 1922 and since then has been used extensively for the manufacture of all types of corrosion resistant chemical equipment. The rights to manufacture Haveg in this country were recently acquired by the Continental-Diamond Fiber Co., and the Haveg Corporation was formed to manufacture and market Haveg corrosion resistant chemical equipment.

Calco Appointed Exclusive Sales Agent

The Calco Chemical Company, Inc. of Bound Brook, New Jersey, has been appointed exclusive sales agent for the Ultramarine Company of New York City. For many years Calco and Heller & Merz have marketed the bulk of the Ultramarine Company goods and now the sales have been placed entirely in their hands. The National Ultramarine Company brands, which were acquired two years ago, are also included.

NOPCO To Build Addition

Mr. C. P. Gulick, President of the National Oil Products company, Harrison, New Jersey, has announced plans for the immediate erection of a four story building which will add 50,000 square feet of floor space to the present plant. This expansion has been made necessary, according to Mr. Gulick, by the numerous new products developed by the National Oil Products Company and successfully marketed. The Company, originally making sulphonated oils for textile and leather trades has expanded its activities to include products for food, cosmetics, paper and various other fields.

New Sample Card

Sample card No. 996 of the Society of Chemical Industry in Basle, "Rigan and Direct Dyestuffs for Streaky Viscose," illustrates the substantive dyestuffs of the Ciba company which are said to be especially suited for dyeing streaky viscose. Special emphasis is laid on such Direct and Chlorantine Fast dyes as are possessed of the property of dyeing evenly on streaky viscose, exclusive of the Rigan Dyes, the special products for the dyeing of streaky Viscose. It is therefore advisable to give such dyestuffs a special designation in addition to their ordinary name.

It should also be noted that in using rayon of differing twists in the same fabric, even with these dyestuffs, it is hardly possible to obtain entirely even results.

Rayon Dyeing and Finishing

(Continued from page 240)

tion and are present in the finished fabric. These oils give the fabric a pleasingly soft hand, and are often used solely for this purpose.

Many of the finishing and softening oils on the market consist of sulfonated oils and fats in conjunction with unsulfonated oils and fats. The various trade compounds differ so greatly from one another that it is impossible to make any general statement covering this field. Most of the finishing oils and compounds offered the rayon dyeing and finishing industry will result in the production of rancid goods under some conditions, but on the other hand, when properly used will produce satisfactory results.

Excessive quantities of fatty acid and sulfonated animal and vegetable oil compounds often result in the production of weak as well as rancid goods upon storage.

Solvents

Textile solvents such as soluble pine oil, hydrogenated hydrocarbons, benzine, toluene, xylene, gasoline, carbon tetrachloride, etc., can be safely used in conjunction with the regenerated cellulose rayons. Such solvents can be used as local spotting agents before or during the scouring operation, or as additions to the scouring bath.

Acids

It is always dangerous to use acids in conjunction with cellulose fibers as even small quantities of acid, if allowed to dry in these fibers, will cause very serious weakening to take place.

In general, the regenerated cellulose rayons react to acid in the same manner as normal cellulose fibers (cotton) with this exception:

The resistance of regenerated cellulose to acid is considerably less than the resistance of cotton to the same concentrations of the same acids.

Appreciable quantities of acid can be used in conjunction with regenerated cellulose rayons when the treatments are not too drastic with respect to concentration, temperature and time for the particular acid used.

The organic acids (acetic, formic, etc.) can be safely used in weak (1-2% based on the weight of the goods) concentrations without injury to the fiber.

The inorganic acids—sulfuric, hydrochloric, and nitric—can be used in surprisingly strong concentrations, provided that the temperature is not allowed to rise too high and the time of treatment is not too long.

In every instance where acid is used, the goods should be given a neutralizing bath. It is not safe to depend upon rinsing processes to remove the last traces of acid from rayon and rayon containing fabric.

In some branches of the knitting industry, especially in the glove silk and circular knit underwear fabric lines, a demand has sprung up for rayon fabrics containing a relatively high scroop. As a "scroop" finish has never yet been successfully produced without leaving the scrooped fabric in an acid condition, the problem of producing a scroop on rayon fabric without endangering the strength of the fabric has become tremendously important.

Most of the scroop that is at present being applied to regenerated cellulose yarn is produced by working the rayon fabric in a broken soap bath. That is, the goods are treated five to ten minutes in a bath containing the required amount of soap, after which sufficient acid to "break" the soap, plus a slight excess, is added to the dye bath.

The free fatty acid of the soap is precipitated on the fiber and minute traces of free organic acid (acetic or formic) is absorbed and tenaciously retained by free fatty acid.

Further information regarding scroop will be found in Chapter VI.

As oxalic acid is so commonly used to remove iron stains, we feel that it requires some mention here.

It has been found that one to two percent of oxalic acid applied to rayon fabrics at a temperature not exceeding 150 degrees F. successfully removes all traces of iron stains in a relatively short time (5-15 minutes).

This treatment is quite harsh for regenerated cellulose and should be avoided whenever possible. Often iron stains can be removed at a lower temperature.

Peroxide

The use of sodium and hydrogen peroxides as bleaching agents for regenerated cellulose rayons originated with the necessity of bleaching fabrics composed of real silk and rayon,—for example, tricot and milanese.

Peroxide solutions can weaken regenerated cellulose rayons when applied to the same at a temperature exceeding 150 degrees F. Due to this fact, most plants using hydrogen peroxide on regenerated cellulose yarns prefer to apply it at or below 130 degrees F. This procedure allows a fair margin of safety.

Some plants are carrying on a simultaneous scouring and bleaching action. Although many thousands of pounds of fabric have been successfully processed by the use of sodium peroxide applied during the last ten minutes of the scouring operation, nevertheless, this procedure does not constitute good practice.

Hypochlorites

Sodium hypochlorite solutions are used to bleach at least 95% of all regenerated cellulose yarns that are subjected to a bleaching operation. There are many successful methods of application, the details of which vary within the following limits:

Temperature:

From 40 degrees F. to 212 degrees F.

Time:

From two minutes to twelve hours.

Available Chlorine—quantity used:

From one-half the quantity necessary to produce a full bleach to several times the theoretical amount necessary.

pH: From a moderately strong alkaline solution to a very mild acid bath.

As the various processes used have been originated to meet special conditions and requirements, it is obviously impossible to state which of these is the best. We will limit ourselves to a discussion of the action of chlorine on regenerated cellulose under various conditions.

Sodium hypochlorite in acid solution has a violent bleaching action as well as a violent disintegrating action on regenerated cellulose yarns. Acid solutions containing sodium hypochlorite should only be applied to rayon cold and in great dilution.

Neutral sodium hypochlorite solutions have a strong bleaching action and will not harm regenerated cellulose yarns when applied to the same in concentrations not exceeding 1¼% available chlorine based on the weight of the goods treated, in a 20-1 bath, at or below room temperature. A clear white bleach can be produced by the reaction of neutral sodium hypochlorite solution on rayon.

Alkaline sodium hypochlorite solutions are much more mild in their action than are the neutral and acid solutions. That is, the speed of reaction of alkaline hypochlorite solutions is inversely proportional to the quantity of alkali used. Many bleaching processes in use at the present time take advantage of this fact and utilize alkaline sodium hypochlorite solutions in order that the bleaching operation shall be carried on slowly and gently.

Potassium Permanganate

Some dye houses are still using the permanganate process of bleaching rayon and rayon containing fabrics. This is because potassium permanganate produces a particularly clear white when properly applied (improperly applied, it can very easily ruin the fabric processed.)

When used for bleaching textiles, permanganate is always used in a mild acid solution as the clearest white is produced from permanganate when it is used in an acid bath.

The action of potassium permanganate is controlled by the acidity of the solution in which it is applied. When too much acid is used, permanganate reacts so violently with the rayon and even with cotton that the fibers are seriously tendered and in some instances rendered worthless.

When large quantities of permanganate are added to bleaching baths, the resulting bleach is decidedly unsatisfactory. The well known brown deposit of manganese dioxide (MnO_2) is immediately formed on the fiber, and effectually prevents the remaining permanganate from exerting its normal bleaching action on the yarn.

The correct way to apply permanganate to rayon and rayon containing fabrics is as follows:

(1) After the usual scouring procedure, rinse the goods free from soap.
(2) Add ¼% sulfuric acid to a cold water solution containing the fabric to be bleached.
(3) Add potassium permanganate solution slowly during one hour; the additions being made at such a rate that the bleaching bath shows a very light pink shade at all times. Continue the addition of potassium permanganate until the fabric has turned a medium brown shade.
(4) Rinse.
(5) Run the goods 10-15 minutes in a bath containing 2% sodium bisulfite.
(6) Rinse and neutralize with soda ash. The use of permanganate as a bleaching agent of rayon and rayon containing fabrics is very limited as its method of application is too bothersome.

Sodium Bisulfite

Sodium bisulfite is applied to regenerated cellulose fabrics only as an anti-chlor and as a means of dissolving manganese dioxide from permanganate bleached fabric. It is always applied at room temperature in concentrations ranging from ½% to 3% of sodium bisulfite, based on the weight of the goods treated.

Under the above described conditions, sodium bisulfite exerts no harmful action whatsoever upon rayon.

If fabric treated with sodium bisulfite is not subsequently dyed, it should be thoroughly rinsed and neutralized. No acid from the bisulfite treatment should remain in the fabric.

Hydrosulfites

Under this heading we include the various stripping agents that base their action upon the oxidation of reduced sulfur compounds. The more important of these compounds are:

1. Sodium Hydrosulfite
   $Na_2S_2O_4$
2. Sodium Sulfoxylate-Formaldehyde
   $NaHSO_4 \cdot CH_2O \cdot 2H_2O$
3. Basic Zinc Sulfoxylate-Formaldehyde

$$Zn\begin{matrix}/OH \\ \backslash HSO_2 \cdot CH_2O\end{matrix}$$

(Continued on page 262)

Knitting Arts Exhibition

THE twenty-ninth annual Knitting Arts Exhibition will be held, as usual, in Philadelphia during the week of April 24th-28th. The exhibition, which is under the auspices of the National Association of Hosiery and Underwear Manufacturers, will take place at the Commercial Museum. The annual meeting of this association will be held on Thursday, April 27th.

Plans for the show are being carried out by General Manager Albert C. Rau, successor to the late Chester I. Campbell. Earl Constantine, managing director of the association is cooperating with him to make the coming exhibition as successful as its predecessors.

Among those exhibits which are of particular interest to our readers are the following:

American Aniline & Extract Co.
Philadelphia, Penna.
Booth 85.

The booth will be used for reception purposes. A. B. McCarty and staff will be in attendance.

American Laundry Machine Co.
Cincinnati, Ohio
Booths 226, 227 *and* 228

They will show the most modern type of equipment including the American Monel Metal Super Rotary Hosiery Dyeing Machine in the 25 and 50 lb. sizes and new Hydro-extractors. They will also exhibit the American Silk Impregnator which is used to replace ordinary tub soaking methods in the soaking room. Those in attendance will include H. G. Mayer, C. F. Fischer, R. C. Caine and possibly one or two of the company's foreign agents.

Bausch & Lomb Optical Co.
Rochester, N. Y.
Booth 152

They will have on display the following types of products: optical instruments for the textile mill and laboratory; working exhibits of microscopes, including wide field, stereoscopic, laboratory, polarizing and spinnerette types; projection apparatus for studying defects in yarns and fabrics; pocket and hand glasses; and pick and course counters. Special features which they will emphasize include: projection instrument for determining fiber diameters and lengths; textile projector for studying either transparent or reflected light or both; latest means of inspecting spinnerettes by aid of optical instruments. W. H. Slocum will be in charge and will be assisted by J. I. Wexlin.

H. W. Butterworth & Sons, Co.
Philadelphia, Penna.
Booths 283 *and* 332

The main exhibit will consist of a laboratory model, single package capacity, Ultra Package Dyeing machine. They will also exhibit a 4-string piece dyeing machine of Haveg construction. The tub, oval winch, idler reel, etc., will be of Haveg construction throughout, as will all parts of the machine with which the goods or liquor come in contact. Both machines will be motor driven. The members of the Butterworth organization in attendance will be: A. W. Butterworth, president, J. Ebert Butterworth, Harry W. Butterworth, Jr., Dehaven Butterworth, William E. H. Bell, and Albert Molt.

E. F. Houghton & Co.
Philadelphia, Penna.
Booths 63 *and* 63-*AA*

They will exhibit several new developments in soaking oils, boil-off agents and finishing materials for silk, rayon and cotton hosiery and other knit goods. Another interesting development exhibited for the first time will be Vim Tred leather belting, a non-skid leather belt which has a treaded surface similar to that of a non-skid automobile tire. Among those found in attendance will be G. W. Pressell, H. C. Roberts, V. W. Wells, G. S. Rogers, W. A. Beuchner, C. G. Schultze, and H. J. Waldron.

International Nickel Co.
New York, N. Y.
Booths 75 *and* 76

The exhibit will feature the corrosion-resistant materials, Monel Metal, Nickel, and Nickel Clad Steel, in mill and fabricated forms, for use in conjunction with bleaching, dyeing and finishing equipment. They also plan to exhibit a 96" x 54" x 54" Nickel Clad Steel piece goods dyeing machine. The superstructure of this machine will be made of Monel Metal. The representatives on hand will be: E. A. Turner, C. J. Biancowicz, F. L. LaQue, J. F. Smith, R. B. Nation and H. G. Turner.

Onyx Oil & Chemical Co.
Jersey City, N. J.
Booth 316

Onyx will feature its new series of compounds: aliphatic ester sulfate and glyceryl sulfates: stressing particularly their application to hosiery, underwear and knit goods. Also on display will be samples of hosiery and underwear processed with the various Onyx compounds. C. D.

Ehrengart, C. E. Maher, J. W. Huber, E. W. Klumph and L. P. Brick.

The Permutit Co.

New York, N. Y.

Booth 101

They will exhibit a working model of their new automatic zeolite water softener, a single valve control unit, Ranarex Mechanical CO_2 Indicator and Recorder, samples of zeolites and a projection machine showing lantern slides of water treating equipment and their application. M. F. Corin will be in charge.

Scholler Bros., Inc.

Philadelphia, Penna.

Booths 128 *and* 129

They will show their complete line of textile soaps, softeners, sulfonated oils, specialties and finishes. Samples of hosiery and knit goods finished with their various products will also be shown. J. F. Noble, George Pickering, L. M. Boyd and F. C. Scholler will be in attendance.

Smith Drum & Co.

Philadelphia, Penna.

Booths 2 to 9 inclusive

They will have on exhibition their usual line of hosiery dyeing machines and hosiery inspection machines. Those in attendance will be Geo. E. Drum, Harry S. Drum, Nelson M. Smith, W. C. Dodson and R. D. Howerton.

Jacques Wolf & Co.

Passaic, N. J.

Booth 393

They will have on exhibition their new offering of soluble oil specialties for the throwster, knitter and weaver of both rayon and silk. Among these are Wolf Silk Oil F, Wolf Silk Oil O, Wolf Silk Oil S and Wolf Rayon Oil W-415 A. The booth will be in charge of Fred G. Henkel who will be assisted by G. J. Desmond, Arnold Pfister, Mr. Searell and other members of the sales staff.

Rayon Dyeing and Finishing

(Continued from page 260)

4. Normal Zinc Sulfoxylate-Formaldehyde

$$Zn\begin{matrix}/HSO_2 \cdot CH_2O \\ \backslash HSO_2 \cdot CH_2O\end{matrix}$$

Of the above listed stripping agents, the most commonly used is sodium hydrosulfite. Sodium hydrosulfite exerts a very gentle stripping action at temperatures at or near the boil from an alkaline bath. This material is widely used as a stripping agent, because of its gentle action.

All of the hydrosulfite compounds are occasionally used for stripping purposes, and all will give satisfactory results when correctly used.

Incorrectly used, all of these hydrosulfites can seriously shorten the life of the stripped fabric. In extreme instances, the fabric is shrunk appreciably, its elasticity is reduced, and its luster destroyed.

The hydrosulfite compounds, in common with other reducing compounds, form small quantities of hydrocellulose from regenerated cellulose yarns, when the treatment is too drastic.

Titanous Stripping Agents

Titanous stripping agents are occasionally used in conjunction with rayon fibers. These materials can be successfully used on rayon without injury. Most dyers prefer to use a milder stripping agent whenever possible, because textile fabrics should be treated gently when possible, and, because of the present high market price of titanium stripping agents.

Diazotizing and Developing Baths

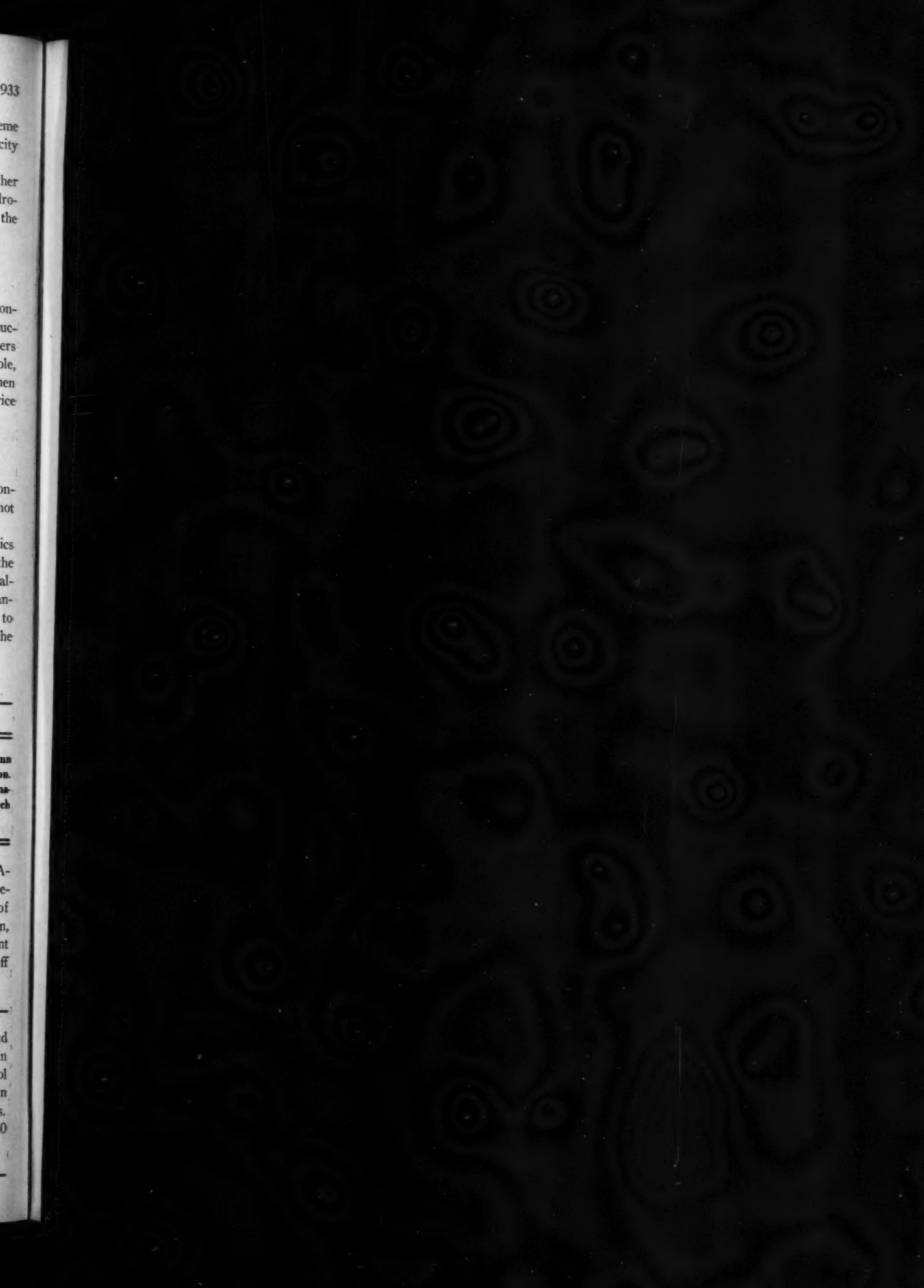
The diazotizing and developing chemicals, in the concentrations in which they are customarily applied, will not injure regenerated cellulose rayon.

In some instances, diazotized and developed fabrics have shown chafe marks that have been blamed on the diazotizing and developing process. Investigation has always shown that the chafe marks were due to mechanical abrasion caused by the excessively long treatment to which the fabric had been subjected, rather than to the action of the diazotizing and developing chemically.

(*To be continued in next issue*)

CLASSIFIED

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

CHEMIST SUPERINTENDENT DEMONSTRATOR—Practical experience in laboratory and every department of a finishing plant. Thorough knowledge of bleaching, dyeing, printing, and finishing of cotton, rayon, Celanese, linen and silk mixtures, etc. Excellent references. Address Box No. 774, American Dyestuff Reporter, 440 Fourth Avenue, New York.

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